

'72 Cars: Why You Should Buy Now

MINICYCLES:
New all-family sport

Page 140

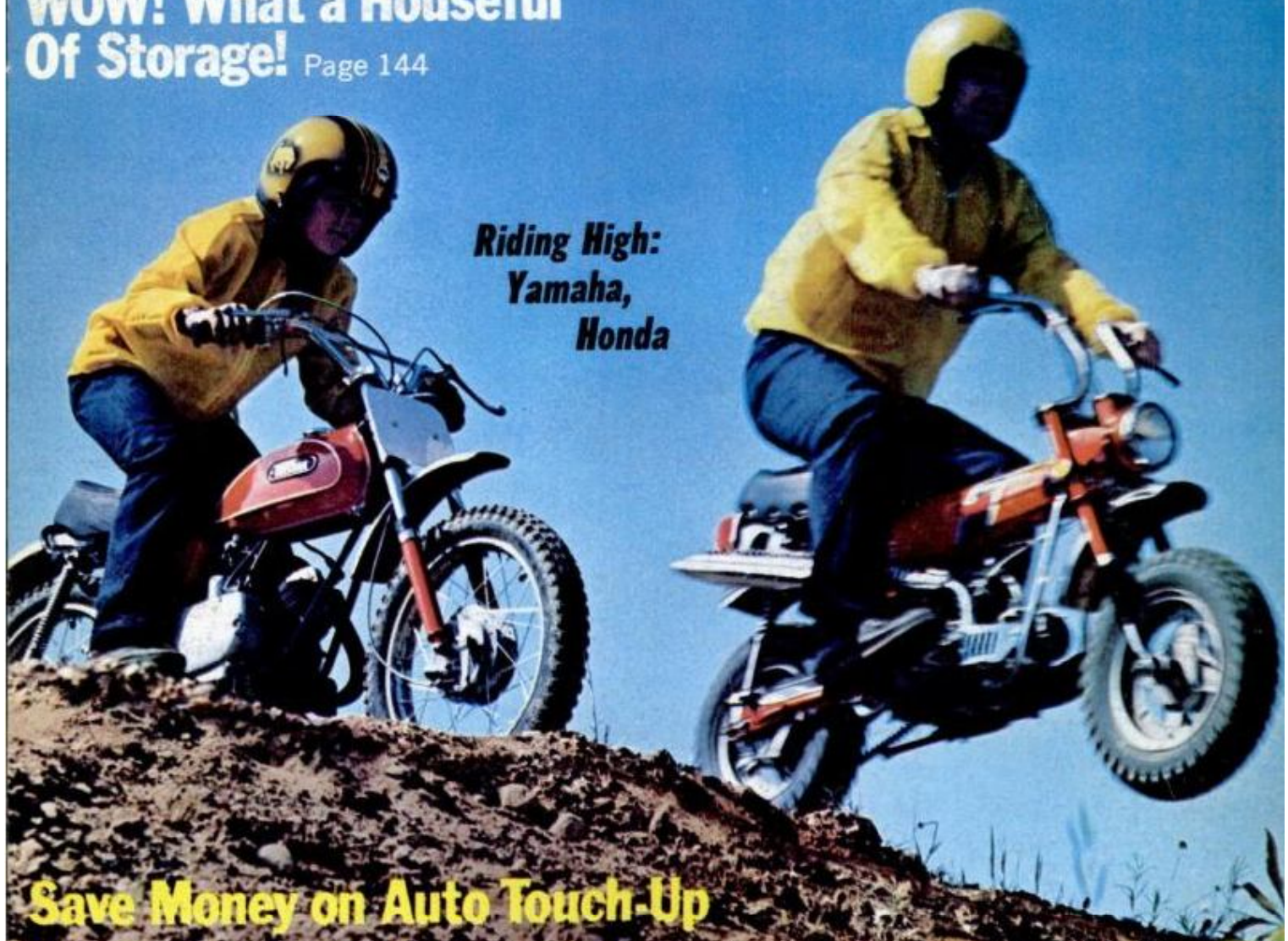
POPULAR MECHANICS

OCT. 1971
50 CENTS

40 TIPS That Save Time,
Work, Money Page 171

**WOW! What a Houseful
Of Storage!** Page 144

*Riding High:
Yamaha,
Honda*



Save Money on Auto Touch-Up

Wankel-Engine Car: First Owners Report!

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And everything in between.

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14 more Evinrudes — including a new 65 hp Triumph and the 50 hp Lark — the versatile loop-chargers that are turning mid-range motors into a new performance class.

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See them all at your Evinrude dealer — soon. Or send a postcard for a free color catalog. Evinrude Motors, 4241 N. 27th Street, Milwaukee, Wisconsin 53216.

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The Norelco 200: This is the famous Norelco cassette that is the standard of the industry. It's perfect for fine music recording. The finest quality Low Noise tape most people will ever need. Of course, it comes with a factory lifetime guarantee.

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Norelco



884H-BHD-S982

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OCTOBER 1971

1



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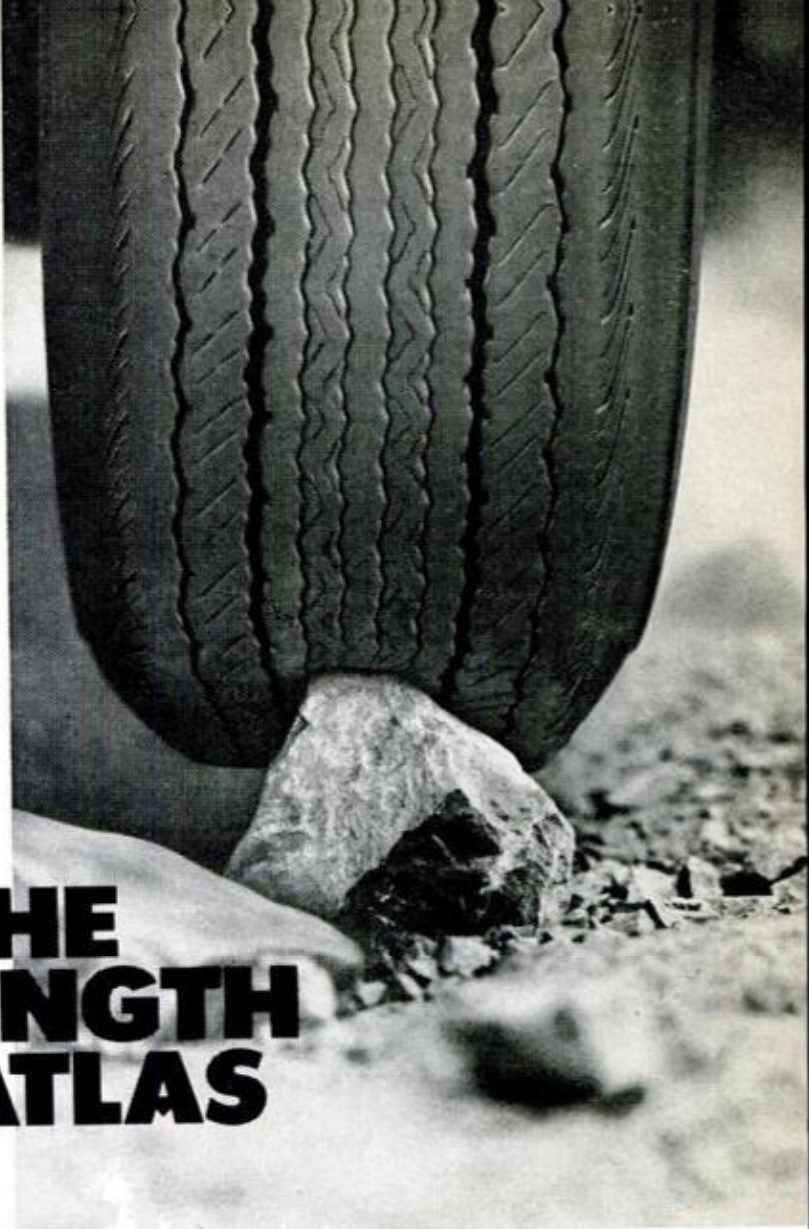
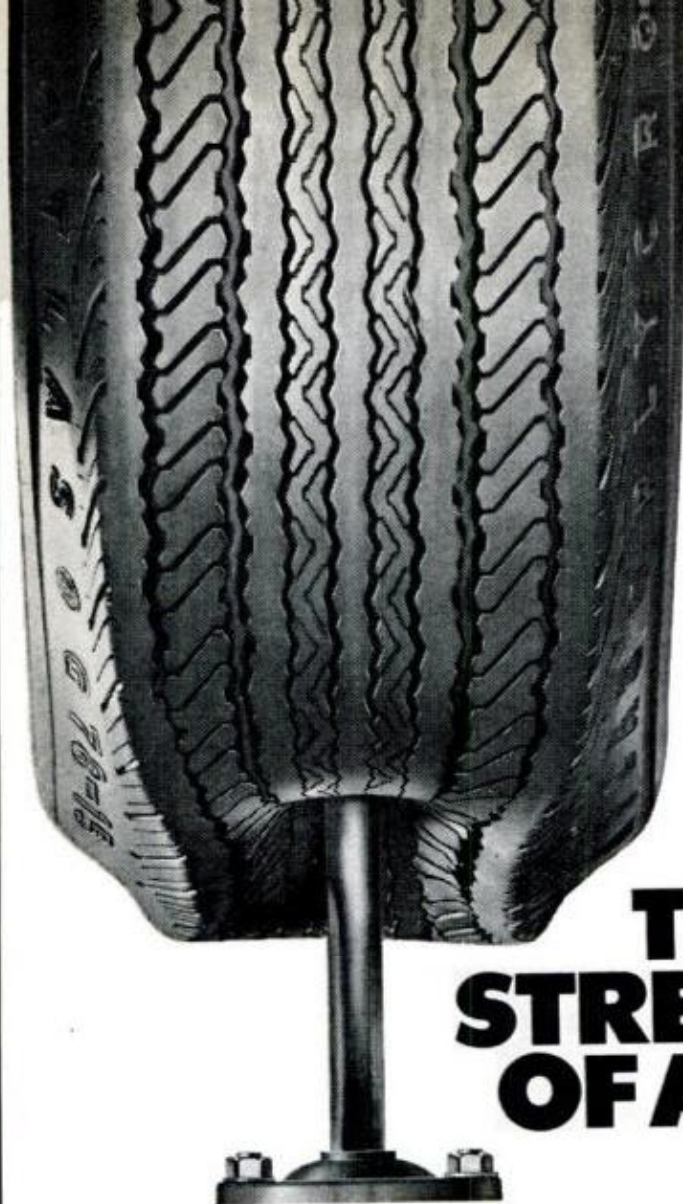
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Riding High With the New Minicycles—Medium-Sized Fun Machines the Whole Family Can Ride

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- Snowmobile Ordeal at 10,000 Feet**
- 300-MPH Monorail**
- Football's Instant Replay: How It Works**

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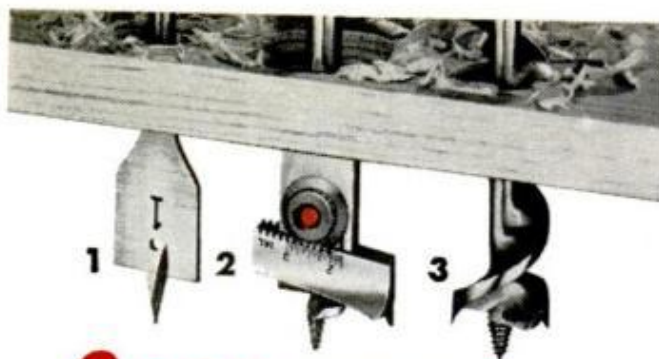
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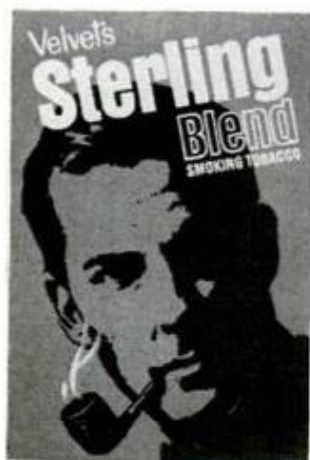
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LETTERS TO THE EDITOR

Museum: a wild goose chase

Thank you for sending me and thousands of others on a wild goose chase to see the museum that isn't there (*The Wings of Brave Men*, page 62, July PM): The Air Force Museum is not completed and will not be for a while.

DAYTON, OHIO

GEORGE BEEKER

When we prepared the story, the Air Force had no doubt that the museum would be opened in May or June. But there was "slippage." There have been 45 aircraft on exhibit (outdoors) since the first week of August, and, as of this writing, the museum is scheduled to be fully opened and dedicated in September.

Car Repair Annual

I like your articles on automobile maintenance; I'm a "Saturday Mechanic" too. Saves me many dollars. Do you have a booklet containing these articles?

SAN CLEMENTE, CALIF.

W.E. CHAPLINE

A brand-new one, the 1972 Car Repair Annual. It's on your newsstand now. (If you can't find one, order it for \$1 from Popular Mechanics, Dept. JL, 224 West 57th St., New York, N.Y. 10019.

But our readers are extraordinary

Please do not give your readers any more stupid articles on boats that dive and cars that fly. This sort of article is spectacular but it sickens ordinary readers.

This letter is written with the hope of making PM a better magazine and I hope you would accept the criticism in good spirit.

SAN FRANCISCO

'A SUBSCRIBER'

We were in good spirits until you wrote. Criticism sickens ordinary editors.

One flat and you're sunk

The article, *Inner-Tube Float Fishing* (page 74, Aug. PM), should have mentioned a couple of safety requirements.

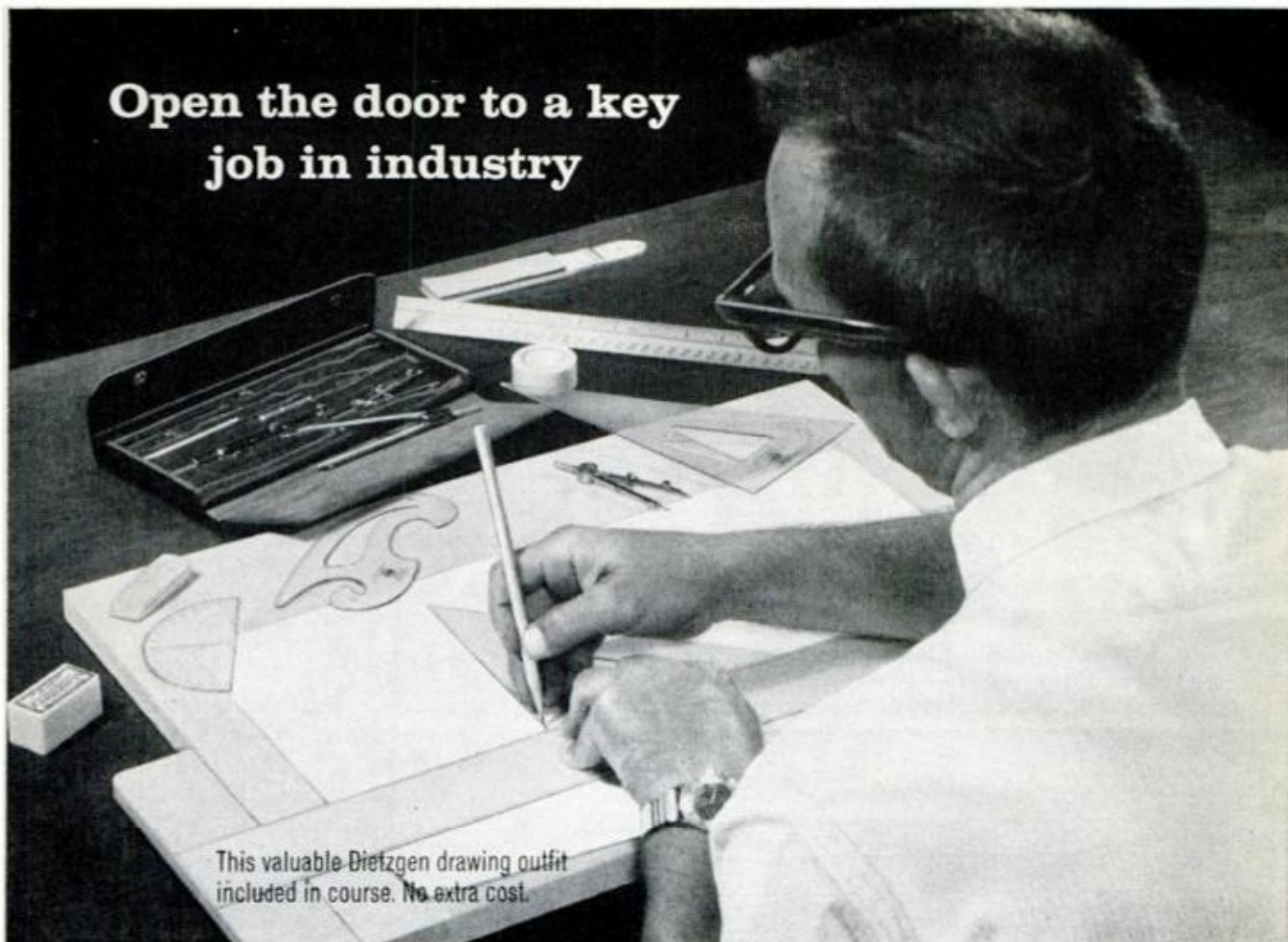
Be sure the inner tube is good and has a valve cap on it; don't trust an old one with patches or cracks. (A flat in the water is more serious than on the car.)

And always wear a life jacket. It's re-

(Please turn to page 8)

POPULAR MECHANICS

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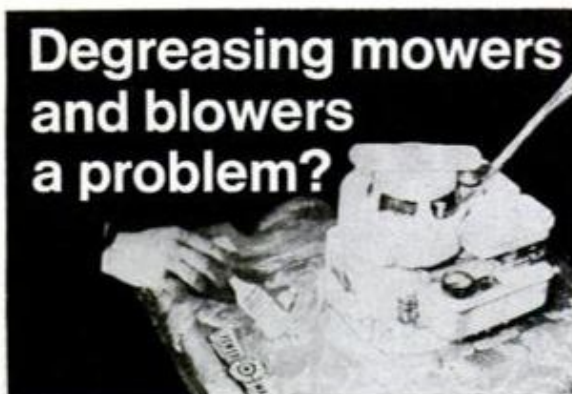
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LETTERS

(Continued from page 6)

quired by law in many places. Otherwise, it's a grand idea!

SWISHER, IOWA

ROBERT D. SMITH

No humor near the hammer, please

Don't you dare add humorous items to *PM* (as suggested by Robert Izenberg in the August *Letters* column). When I'm making any of your projects, I'm very stern and sincere. A joke or comical picture might shift my mind into hysteria and cause me to ruin my work.

MALDEN, MASS.

PETER LEGON

Don't you worry. No jokes! We're stern and sincere too. (But did you hear that one about the farmer's daughter...)

Camper for \$1500

I have a camper that is a little more affordable than your *Motor Home for Under \$3900* (page 136, Jan. *PM*). I built this camper on an old Chrysler chassis. Construction is quite simple; the only



power tools required are a drill and saw.

The unit has a dining area, stove, sink, icebox and head. It has lots of storage space and sleeps four comfortably. Total cost was just under \$1500.

NORTH PALM BEACH, FLA. CAREY BUSSELL

Belted, but not saved

We wonder if the testers use real live wiggling kids when they check out safety standards for car baby seats (*How to Belt Your Kid and Save His Life*, page 100, July *PM*).

Our 22-pound, active 16-month-old showed us two ways to foil the Firestone Protecta-Tot shortly after its purchase.

First, no matter how far into the rear-seat back we pushed the unit nor how tightly we drew the lap belt over it, she managed to wiggle triumphantly out.

Second, no matter how we positioned

(Please turn to page 10)



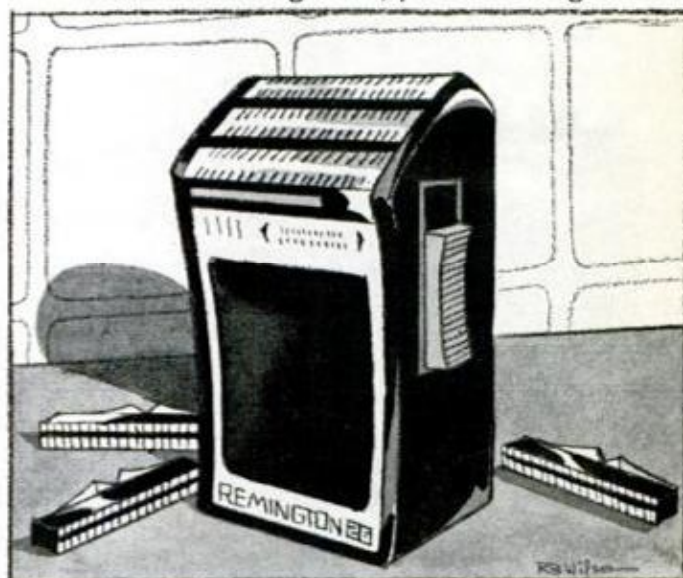
A good shave depends on a sharp blade.



When our blades get dull, you can change them.



Which means you can get back to good shaves.



Our hero and replaceable blades.

Shavers don't get dull. Blades get dull. Remington blades are replaceable.

When your shaver doesn't shave like it's new anymore, you don't have to replace your shaver. You don't even have to replace the head.

Not if your shaver is our shaver. All you replace is the blades. Takes a few seconds every six months or so.

Our newest shaver gives you blades that are super-sharp, so you get a close, comfortable shave; because they're replaceable, we can make them about four times as sharp as our permanent blades were.

We also gave this shaver a new slanted design that's convenient to use, and our Hideaway™ trimmer because we thought it should have everything.

After all, the blades are replaceable, but the shaver is permanent.

REMINGTON
LEKTROBLADE® SHAVER

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SPERRY RAND

OCTOBER 1971

9

Материал, защищенный авторским правом

LETTERS

(Continued from page 8)

the buckle, it always stayed close enough for her to play with—and release.

Incidentally, we scored even lower than *PM* in trying to locate a recommended seat. Not one of the five Ford agencies listed in our phone book had a Tot-Guard in stock. Nor did we fare any better with the three Firestone dealers.

MR. AND MRS. H.R. PHILLIPS
COLTS NECK, N.J.

'Bursting with indignation'

I'm bursting with indignation. Mr. Lund is lucky to be out of my reach—I'd



pin his ears back. How dare you say in the June issue that Packards "... rust in memory." (*New for '72*, page 63).

Look at this picture of my 1928 Model 526 six-cylinder Packard. It's in constant use, goes where I want it to go and returns: That's all any *new* auto can do.

TWEED, ONT.

F.L. TRUDEAU

You think the desert's bad?

I read *How to Survive in the Desert* (page 108, Aug. *PM*). But did you ever wonder what a jungle is like with trees that hide all sunlight, dirty brown water and when a mosquito bites your arm it swells up twice its size? Then there are snakes that bite you dead within minutes or a little longer. It's like a pressure cooker with the cover on and you're inside wet with sweat.

DASSEL, MINN.

ROBERT DRISCOLL

We hadn't really wondered about a jungle, but you've given us something to ponder.

PM catalog

I'm one of your more loyal readers and have *Popular Mechanics* magazines dat-

(Please turn to page 12)

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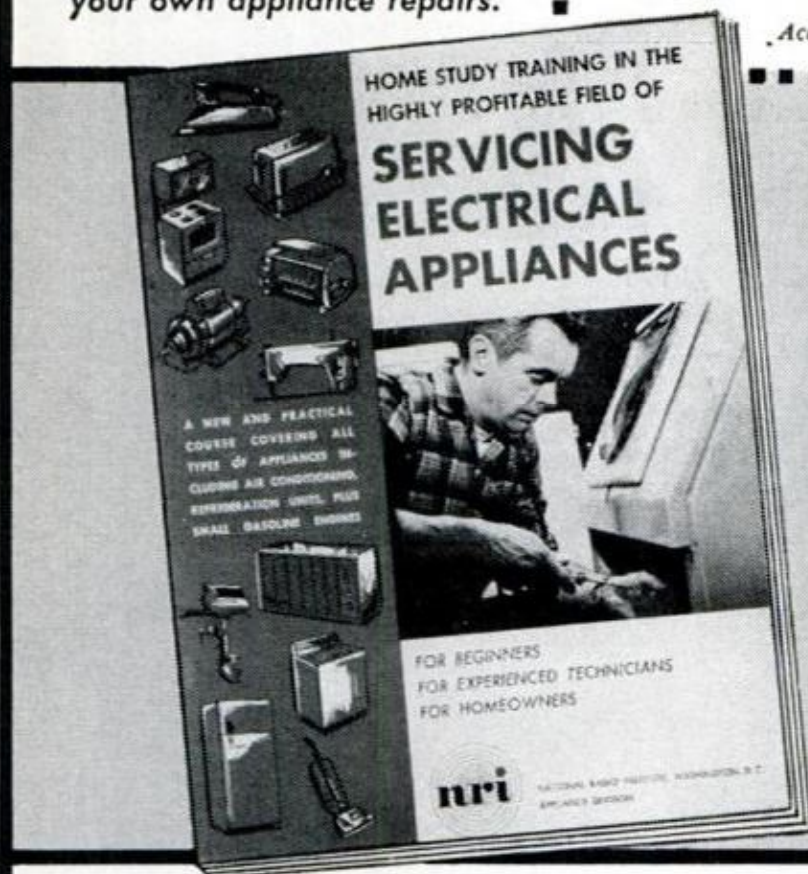
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LETTERS

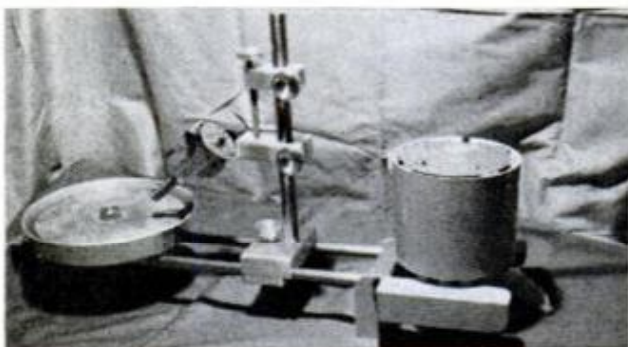
(Continued from page 10)

ing back as far as 1925—and I still enjoy it. I'm glad to send a quarter to pay for postage and handling of your plans and publications catalog.
LACEY, WASH. MARK KELLOGG

Faithful long-time readers and new readers, too, can get the catalog for 25 cents. Write for the Plans, Publications, Projects Catalog, Popular Mechanics Service Bureau, Dept. JL, 224 West 57th St., New York, N.Y. 10019.

Gemstone faceting machine

It took me two or three weeks, part-time, to complete the *Gemstone Faceting*



Machine (page 156, Feb. PM); it's made entirely of stainless steel and aluminum. The project gave me much pleasure.
NEWARK, DEL. RICHARD WEST

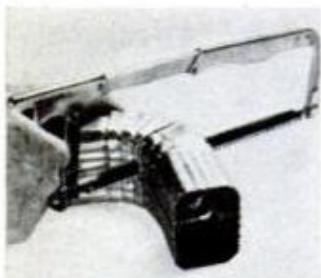
Great Workshops fan

I'm an electrician, and I enjoy your series on Great Workshops. My workbench is 10 feet long and 30 inches wide.

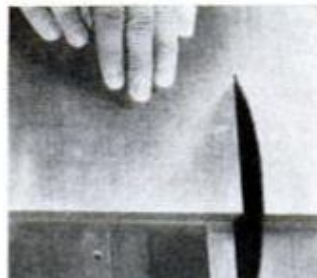


All of the perforated hardboard has half-inch molding on it.
ALLENTOWN, PA. CALVIN HERTZOG

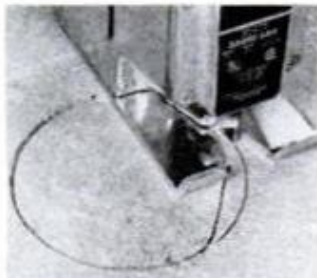
Yours looks neater than most workshoppers' shops. (And we're continuing the series. Another dandy will be along in two or three months.) ★★★



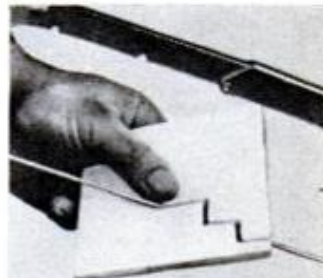
Hacksaw Blade. New! Virtually unbreakable. Makes thin, straight cuts. No need to protect the edge when you carry it in your toolbox.



Circular Saw Blades. New! No need to change blades when you change materials. Come in 6½", 7", 8" and 10" diameters, to fit most saws.



Saber Saw Blades. Universal ¼" shank saws, coarse grit for fast cuts, fine grit for smoother cuts. Make plunge cuts in tile, cut small circles. Also available in 4" and 6", ½" shank.



Rod Saw. Thin, round blade cuts in any direction. Ideal for contour cutting. Reversible for extended life. Ten-inch length fits standard hacksaws.

Remington "Grit-Edge" Saw Blades Have No Teeth. They're Something Else!



That's right, "GRIT-EDGE" blades have no ordinary saw teeth to snag, break or dull. Instead, an exclusive process permanently bonds tiny tungsten carbide particles to each blade. "GRIT-EDGE" blades are inherently safer than blades with conventional teeth. "GRIT-EDGE" blades cut almost everything, including things ordinary blades can't touch. They're designed to cut extremely hard or abrasive material. And they last up to ten times longer.

They can cut glass, cement-asbestos, tile, fiber glass and the hardest metals; make smoother cuts in veneers and laminates; help you do jobs you couldn't try before.

In fact, a low-cost "GRIT-EDGE" blade can do jobs that used to take expensive industrial cutting tools. See the "GRIT-EDGE" blades at your local hardware dealer's now.

Remington® DU PONT

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**Unfortunately, your new 1972 winter
will soon be ready for delivery.**



**Fortunately, a new Firestone Town & Country[®] tire
that will change the way you feel about driving in
winter is ready for delivery now.**

Why, when we already make a great winter tire, did we make a new "asymmetrical" winter tire with three different tread sections instead of two, designed to hold eight rows of studs* instead of six, with such a unique tread design that it can be put on the front wheels as well as rear?

We make this Town & Country tire for days when the temperature is low and the snow is drifting and the wind is whistling and the roads look like a tile floor.

We make this tire for people who ski and snowmobile, people who get out in winter

and go looking for the places where winter has really moved in.

We make this tire for policemen and doctors and everyone who doesn't have any choice about getting out and going when the bell rings.

We make this Town & Country tire for you if you worry even a little about driving in winter, to work, to school, to the store.

And we make it available wherever you see the Firestone sign—at most locations you can even charge them.

**Studs not available where prohibited by law.*



Firestone

The "asymmetrical" Town & Country

**You go through ice, mud, or
snow or we pay the tow!**

**AMERICAN
MOTORS
INTRODUCES
THE
GUARANTEED
CAR.**

If anything goes wrong with one of our 72's and it's our fault, we'll fix it free. Anything.

AMERICAN MOTORS 1972 BUYER PROTECTION PLAN.

For years, car buyers in this country have been saying that instead of shiny new chrome every year, what they really want is a good car they can count on.

That's why American Motors and its dealers put together their 1972 Buyer Protection Plan.

Here's how it works:

A STRONG GUARANTEE IN PLAIN ENGLISH.



When you buy a new 1972 car from an American Motors dealer, American Motors Corporation guarantees to you that, except for tires, it will pay for the repair or replacement of any part it supplies that is defective in material or workmanship.

This guarantee is good for 12 months from the date the car is first used or 12,000 miles, whichever comes first.

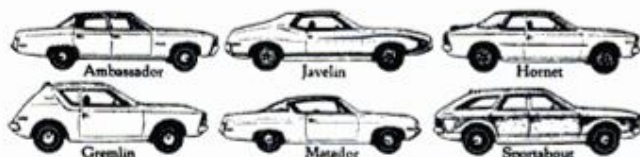
All we require is that the car be properly maintained and cared for under normal use and service in the fifty United States or Canada and that guaranteed repairs or replacements be made by an American Motors dealer.

This guarantee gives you 12-month or 12,000-mile coverage on a lot of things most car warranties don't. It covers air conditioning, battery, radio, wiper blades, front end alignment, light bulbs—literally everything we put on the car except tires.

In other words, if something we did goes wrong with one of our '72's, you won't have to pay for the parts or the labor. We will.

A MORE THOROUGHLY-CHECKED CAR. FROM THE FACTORY AND THE DEALER.

Naturally, we wouldn't be backing our cars like this if we weren't more sure of



them than we've ever been before. For 1972, we've put in more quality control steps, more tests and more people to see that every car leaving our factory is as perfect as man and machine can make it.

At the dealer's, it's checked over again.

Every car (not one of 50, one of 5, every one) is road-tested for starting, handling, braking and overall performance. When the serviceman completes the test, he signs his report and slides it over the sun visor, where you can see it.



And, when a man signs his name to something, you can be sure he's done his job. And done it right.

A LOANER CAR WHEN YOU NEED IT. FREE.

Not only do we offer you a strong guarantee, we've set up a system to back it up without inconveniencing you.

If you have to leave your '72 overnight for guarantee repairs, over 2,000 dealers will loan you one of their cars. A nice, clean, well-equipped car in good condition.

Free.



A DIRECT LINE TO DETROIT. TOLL-FREE.



We're making some big promises, and we fully intend to keep them. But, just in case you have a problem, we have a way of handling it. When you buy a '72, you get the name and toll-free number of a person in Detroit.

If you call, we promise you you'll get results. And fast.

These aren't just fancy words. We mean it.

Nobody in the business does as much for you after you buy a car, and it takes a lot of time, men and money to do all of these things.

But we think it's worth it.

Since we're giving American car-buyers exactly what they say they want, we should sell more cars than we've ever sold before.



NEWS BRIEFS



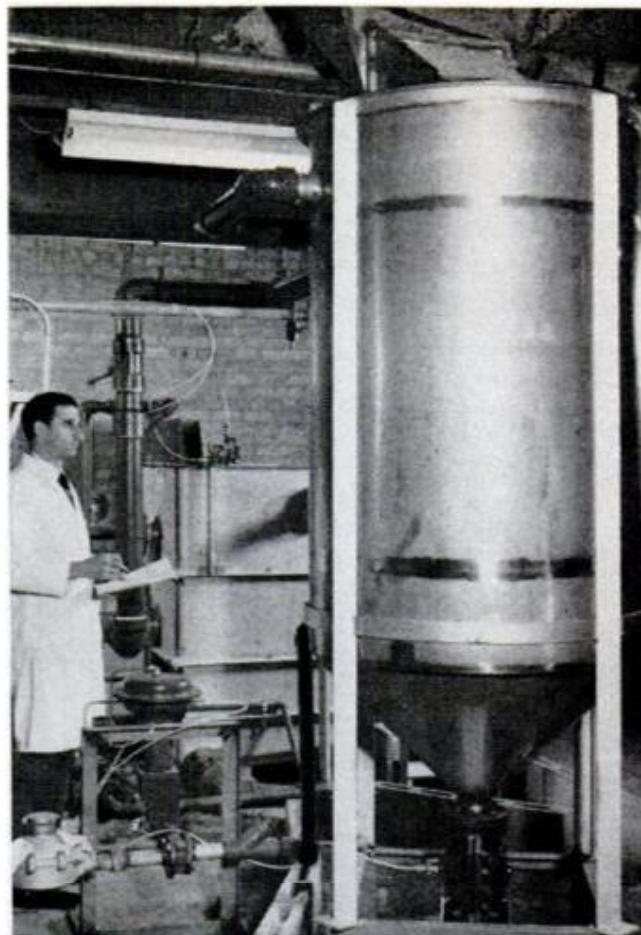
Walking howitzer

Capable of being driven conventionally over hard ground, this 105-mm howitzer can "walk" through deep mud, swamps and other adverse terrain on Lockheed's StarWheel locomotion system. A conventional engine with hydrostatic drive powers the machine.



All-terrain conversion kit

You can convert your minicycle to an all-terrain three-wheeler with a new kit offered by a California firm. According to the maker, the conversion to three wheels can be made in less than an hour. The kit, which sells for \$175, fits both the Honda CT90 and CT70; special installations are available for other bikes. The manufacturer is TAC Trail Accessories of California, Box 734, Citrus Heights, Calif. 95610.



Brine producer

The Brine Mine (top photo), developed by Cargill, Inc., to turn rock salt into pure brine, can save industrial users up to \$6 per ton of salt, according to estimates made by the firm. The new device uses gravity to flush out sulfate impurities from rock salt. While the technique is not new, Cargill notes that the Brine Mine can be employed by small users, food and textile plants that require only 1000 to 3000 tons of salt per year. Salt brine is normally produced from the more expensive evaporated salt, which is somewhat purer than rock salt. The lower photo is of Cargill's salt mine in Louisiana. The rock salt is sliced from the walls by machines, crushed and sent to the surface on conveyors.

After speaking out against everything, Grace Strong relaxed with a radically different cigarette.

Now everybody will be smoking radically different cigarettes

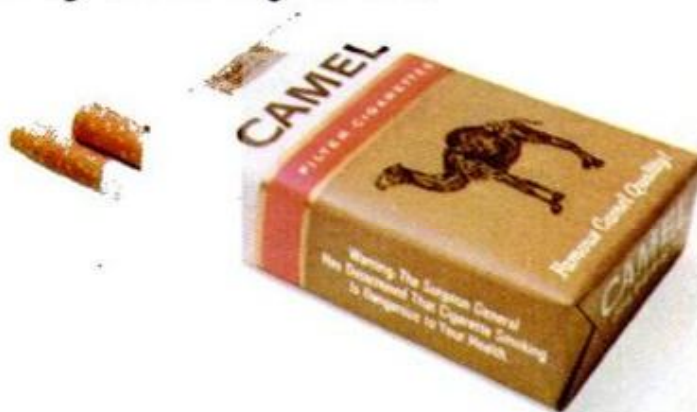


...almost everybody.



©1971 R. J. Reynolds Tobacco Company, Winston-Salem, N.C.

Camel Filters.
They're not for everybody.
(But then, they don't try to be.)



20 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report NOV. '70.

OCTOBER 1971

17

SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Clickish

My 1970 Chevrolet developed a solid clicking noise in its turbo hydra-matic shortly after I got the car. The noise occurs in first gear only, just prior to upshifting to second at low speed. The dealer has replaced the planetary gear assembly and checked first and reverse clutches for tightness, but the clicking is getting worse. A slight buzzing has also developed on deceleration in first. Your help would be appreciated.—Donald P. Jadowski, Toms River, N.J.

A very good possibility is that too much clearance exists between the intermediate clutch plates, because an insufficient number of plates were used. This would result in the reaction plates bouncing against the case. Ask the dealer to replace the intermediate clutch plate stack assembly.

Constant compressor

My son, who has a 1968 Oldsmobile Cutlass, and I, who have a 1970 Delta, both have the same problem. When we turn off the airconditioner while driving, the compressor doesn't shut off. In fact, it won't shut off until you turn the engine off. Several mechanics have been unable to solve the problem. Can you help?—H. Moen, Lynwood, Calif.

Your problem may be no problem at all! Watch the compressor as your son turns the airconditioner on and off. A magnetic clutch engages and disengages the compressor with its pulley which runs while the engine is running. If it doesn't disengage, check the switch and the clutch itself.

Communications breakdown

I recently purchased a standard four-cylinder Pinto that has now traveled 800 miles. My only complaint is that it backfires constantly when downshifting or coasting. My dealer has told me that this is common to the four-cylinder engine and that nothing can be done. What do you think?—Joan Dzikas, Woodbridge, Conn.

I think that your dealer hasn't gotten the "word." Apparently, neither have you. Letters have been sent to Pinto owners by FoMoCo advising them to bring their

cars back to the dealer for installation of a valve in the carburetor outlet to prevent backfiring, which could cause fuel vapors to ignite.

Short changed

At the first oil change of my 1971 Plymouth Duster, my dealer replaced the oil filter with one which was noticeably larger than the one he took off the car. He told me that it was okay, but I have my doubts. Do you know something about this?—George Branford, Syracuse, N.Y.

Yes. What your dealer did was okay. Chrysler Corp. put a so-called "shorty" oil filter on its 1971 models, with exception of police cars, taxis and other fleet cars. However, a "shorty" filter should not be used as a replacement, because it won't give adequate performance if manufacturer oil change recommendations are followed which call for replacing the filter at every other oil change after the first oil change.

Oily water

I have a 1964 Buick Riviera, and I'm getting motor oil into my radiator, but no water into my oil. I've had new head gaskets installed twice, but that hasn't helped. Any ideas?—Raymond Harmon, Elizabethtown, Tenn.

A few. First, I doubt if it is motor oil you're getting into the radiator. The only way that motor oil can get into the radiator is past a bad head gasket. You have had two new ones. If the head gasket were bad, water would also be getting into the oil. I think that what you're getting in your radiator is transmission oil from a hole in the transmission cooler, which is in the bottom tank of the radiator. I suggest you have it checked for leaks by a radiator shop and repaired if possible or replaced if not.

Shake, rattle and roll

My problem is severe engine vibration in a 1970 Pontiac Bonneville with a four-barrel-carb, 455-cu.-in. engine. The engine dies easily when you first crank it and put it into forward or reverse. When in slow

(Please turn to page 22)



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New from Ford, the better-idea people,
two kinds of pickups

The pickup truck

The '72 Ford Styleside.

How can one pickup ride and handle so much better than others? The answer is better ideas only Ford offers. For example, only Ford has Twin-I-Beam front suspension. Each front wheel has its own I-beam axle. Each works independently, stepping over bumps, smoothing the ride. The handling is firm, precise. And there's little sidesway when cornering, practically no

dip when braking. Flexible leaf springs at the rear add stability with big loads. And this year, Ford GVW ratings are up by as much as 600 pounds. Count on Ford for durability, too: 92 out of 100 Ford trucks sold in the past 12 years are still on the job. See the better idea pickup at your Ford Dealer's soon.



It works like a truck,
rides like a car.





The pickup car

The all-new '72 Ford Ranchero.



The best of both worlds—car and pickup—come together beautifully in Ford's completely new Ranchero. It offers you new strength and durability with a solid big-car frame. A smoother, quiet ride with a wheelbase that's four inches longer. And clean responsive handling with a new link coil rear suspension. Front disc brakes are standard, and you can choose any of six spirited engines, up to a 429 V8. This year's Ranchero gives you big new loadspace, too, with a box that's both longer and wider. A four-foot-wide ping-pong table can slide between wheelhousings with room to spare. And if camping or boating's your thing, Ranchero has a new towing package for up to 6,000 lbs. If you need something more than a car, more than a pickup, check out a new Ranchero 500, GT, or Squire. They're something else.

A better idea for safety: Buckle up.

FORD



AUTOMOBILE CLINIC

(Continued from page 18)

motion, everything, including the body, rattles and vibrates. The dealer has checked and rechecked the carburetor, but the trouble remains. Let me add that if you cover the front two barrels, the engine smooths out. Can you advise?—Buford Hall, Hinesville, Ga.

This sounds very much like an air leak, perhaps past loose intake manifold bolts. Air may be leaning out the fuel mixture, and the engine may be starving for fuel. The fact that covering the carburetor smooths out the engine seems to verify this. Essentially, what you're doing is cutting down on air intake. I suggest you tighten all carburetor and manifold bolts. If that doesn't help, check for bad intake manifold gaskets.

Finally, the trouble could be secondary throttle bore leakage caused by throttle-plate misalignment or a warped throttle body. The carb will have to come off, be inspected, then repaired or replaced.

Filter Facts

I would appreciate knowing if washing the large pleated air cleaner element of a 1969 Chevrolet in detergent and ammonia would impair the air-cleaning properties of the air filter. I would like to save the cost of replacement, if possible.—J. Wesley Smith, Hollywood, Fla.

Washing this filter, which is a paper material, will destroy its properties. Unless you live in an unusually dusty area where more frequent servicing is needed, you should inspect the air cleaner element for damage at 12,000 miles. If it is okay, rotate it 180° from its original position and use it for another 12,000 miles. But at the end of a total of 24,000 miles, the element should be replaced.

When to change oil

Undoubtedly this is a common and old problem, but it has me puzzled. Owners manuals say to change engine oil every 6000 miles. My serviceman says to change it every 1000 or 1500 miles. He claims that carmakers want you to grind up engines so they can sell more cars. Is he right?—Keith B. Capron, Colorado Springs, Colo.

He was right about more frequent oil changes 20 years ago. Engines and motor oils have been improved. Follow manufacturer recommendations. However, if the car is subject to severe operational conditions, such as nothing except city driving, oil should be changed more frequently. The owners manuals point this out.

Loss of color

While checking the automatic transmission fluid of my 1968 Chrysler I noticed the fluid no longer had a reddish color, but was dark. Does this indicate something is bad inside my transmission?—David F. Wallar, Amarillo, Tex.

If the color of the fluid is the only "symptom," then nothing's wrong with your transmission. In 1968, a new type of automatic transmission fluid, Dexron, was introduced. It has better qualities than the older Type A, Suffix A fluid. But its different additive chemistry causes the fluid to lose its redness and darken. Keep in mind that with Dexron the life of automatic transmission fluid can no longer be judged by color. This is why it's important to follow the recommended drain interval in your owners manual.

Service Tips

● Some 1971 Thunderbirds are experiencing a rattle in the exhaust system. This is caused by the resonator hitting the bumper bracket mounting bolts. The cure is to use a pry bar to reposition the muffler assembly to get the necessary clearance.

● Oldsmobile offers this method of locating an engine oil leak: Clean the engine with solvent and remove the flywheel lower cover if that is a suspected area. Spray possible leak areas with a pressurized foot powder. Remove the crankcase ventilation valve and seal the openings with masking or cloth body tape. Run the engine at 3000 to 3500 rpm. Pressurization of the crankcase will cause even small leaks to become visible.

● 1971 Mercury with manual airconditioners: if they're not getting enough heat from the heater, owners of such cars should take them back to the dealer and have him re-adjust the temperature control cable as in Service Bulletin 17 ('71 series). ★★

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.

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 1.2 mg. nicotine, av. per cigarette, FTC Report Nov. '70

OCTOBER 1971

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23

How to understand your car when it tries to tell you something.

Your car is a sensitive machine. With a language all its own. A language consisting of wheezes, knocks, groans, clatters, pings, and moans.

You can't afford to ignore these communications. Or guess what they mean.

You need a translator.

We've got one. MOTOR's new 1971 Auto Repair Manual.

This hefty 1,000-page volume has a big Trouble-Shooter section plus detailed trouble-shooting information throughout. To help you pinpoint any of 4,200 problems in the engine, transmission, axle, rear-end universal, or anywhere else.

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And it's all the latest time and money-saving information. Gleaned from more than 300 official factory and service manuals.

In fact, the 1971 edition of MOTOR's covers 2,300 American models built between 1965 and 1971. Dodge, Chevy, Valiant, Mercury, Imperial, Cadillac, Ford, Pontiac, Buick, Corvette. All the hot cars like AMX, Challenger, Mustang, and Camaro. Plus Volkswagen. It gives tune-up specs for 30 foreign makes.



It even has the tune-up and front-end alignment data for 1946-1964 cars.

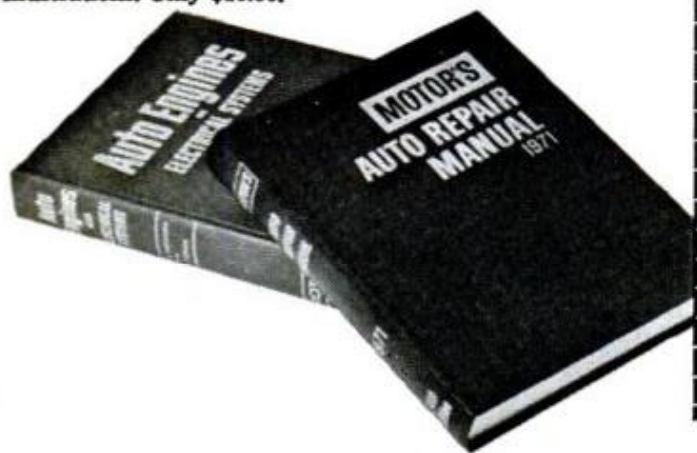
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4 M O S 4 J

ALL BY GEORGE REIGER OUTDOORS

COMMEMORATIVE FIREARMS are attractive, quality-built and a good investment. In an uncertain economy, you're probably better off buying a new .30-30 in a commemorative model with a limited production figure than a standard version numbering into millions.

Some examples of how commemorative arms increase their value are: Remington's Montana Territorial Centennial 600 rifle—sold in 1964 for \$124.95, now worth \$200; Ithaca's St. Louis Bicentennial .22 rifle—sold in 1964 for \$34.95, now worth \$125; and Colt's Geneseo, Ill., 125th Anniversary Derringer—sold in 1961 for \$27.50, now worth \$325!

Of course, these prices are for guns in mint (unfired) condition, and many investment-conscious collectors never even take their purchases from the presentation boxes they come in. But with some commemoratives, it doesn't seem to make much difference about use or volume of production. Winchester produced over 100,000 centennial rifles and carbines in 1966 for a retail price of \$125. That was just five years ago, and already they're worth \$195 apiece!

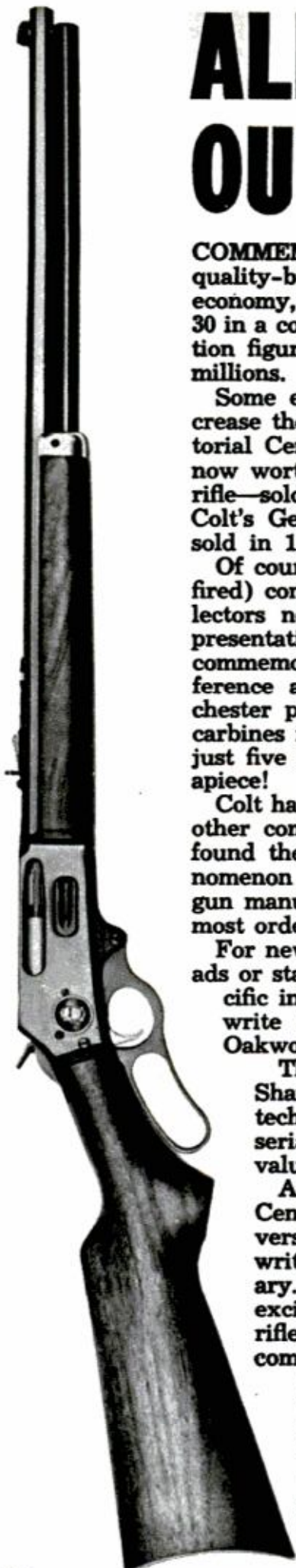
Colt has produced more commemoratives than any other company, and in a recent visit to its plant I found the people there as delighted with the phenomenon as their collector friends. But then, any gun manufacturer is happy with a runoff for which most orders are in before the first barrel is bored.

For news of upcoming commemoratives, watch for ads or stay in touch with your local dealer; for specific information about the value of old issues, write Cherry's Sporting Goods, 1041 South Oakwood Ave., Geneseo, Ill. 61254.

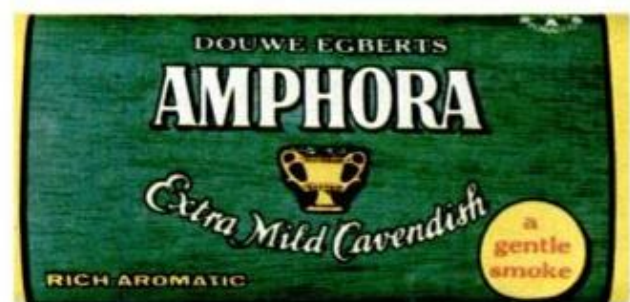
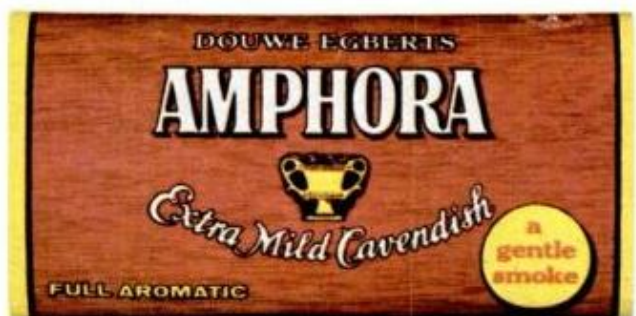
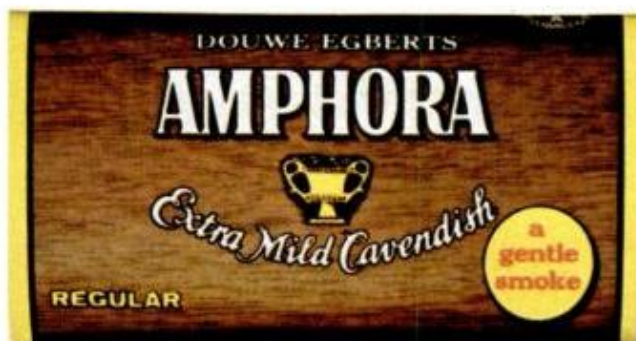
Though Colt's reissue of the historic Sharps-Borchardt Rifle (right) is not technically a commemorative project, early serial numbers of this piece should prove valuable in years to come.

At left is Marlin's Zane Grey .30-30 Century which will honor the 100th anniversary of the birth of this great Western writer and outdoorsman this coming January. For Zane Grey fans, 1972 will be an exciting year. In addition to the Marlin rifle, the U.S. government is planning a commemorative postage stamp to honor

Grey and his sons have asked me to collect and edit his best hunting and fishing tales into a book that's tentatively titled *Zane Grey: American Outdoorsman* and planned for publication by Prentice-Hall early next year. Keep a sharp lookout! ★★★



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OCTOBER 1971

31

APPLIANCE

QUESTIONS ANSWERED **CLINIC** By PAUL MANN

Leaking washing machine

I recently noticed water around the base of our washing machine. What bothers me most is that the water appears at times when the machine has not necessarily been used. There's no great flood, but it's enough to cause concern. Where might the water be coming from?—Charles Mahan, Trenton, N.J.

Some of the most common sources of water leakage are at water-supply hose connections. They may not be tight enough; more often, the hose washers inside the threaded collars have deteriorated with age, allowing connections to leak no matter how tight they are.

Shut off the water supply, pull the machine away from the wall and remove the back panel, if necessary, to reach the hose connections. Remove the hoses at both hot and cold-water inlets to the machine and examine the hose washers carefully. If they're cracked, replace them with new washers. When reinstalling a hose, turn its threaded collar as tight as you can by hand. Then give it another quarter-turn using pliers or similar tool.

Be sure that the collars are not cross-threaded—this is easy to do if you're not careful.

Resharpener electric knives

After many years of service the blades of my General Electric electric carving knife have become dull. Is there any way to sharpen them or should I simply buy a new pair?—Bob Levy, Los Angeles.

As you indicated, this doesn't happen for many years, because the inside blade edges of electric-knife blades rub together to provide a self-sharpening action. However, when the tungsten carbide blades used in all but the most recent GE electric knives become dull, they should be replaced. An attempt to sharpen them will not be successful and could result in damage to the sharpening medium.

Stripped screw holes

I did it this time. I took my wife's Hamilton Beach hair dryer apart for a repair.

In putting it back together again, a couple of screws wouldn't tighten. The two halves of this plastic case are hanging together with chewing gum and a prayer. Can anything be done to salvage it?—Larry Astor, Norfolk, Va.

The mounting screws in this hair dryer, as in other all-plastic appliance cases, project into hollow studs molded into the inside of the case. Overtightening will strip the studs. Try one of these two repairs: You can apply a few drops of a plastic cement into the holes of the studs, put the screws in and let them set. This will make it tougher to take the case apart in the future. Or you can use the next-size-larger screw. For example, if screws presently used in the appliance are No. 6-32 x 1½ in., substitute No. 8-32 x 1½ in.

Disassembling an iron

I have to disassemble a Westinghouse steam iron (Model HS - 39 - 1), but can't find the mounting nuts. Where are they?—Carl Oliver, Baton Rouge, La.

Most steam irons have the mounting nut (nuts) beneath the nameplate, so carefully pry the plate off. Loosen the mounting nut (nuts), disconnect the line cord and lift the shell off the soleplate.

Blown gasket

My problem is too little suction with a Westinghouse vacuum cleaner. I have replaced the bag and thoroughly cleaned out the machine and hose. Where can the trouble be?—Steven Aldrich, Knoxville, Tenn.

The reduced suction may be due to a hole in the hose. Examine the hose carefully. If you find a tear, patch it with plastic tape or a vinyl patching kit you can buy from a swimming-pool supply dealer. Hose damage is most likely to occur at the ends where tubular metal fittings are located. If a fitting is loose or the hose has ruptured at such a point, try repairing it with rubber or epoxy cement. Be especially critical of the fitting at the nozzle end of the hose. It has a built-in swivel joint

which permits the hose to turn as the nozzle is moved. There is a soft rubber gasket inside the tip on the fitting. If it's damaged, the air leak will greatly reduce suction. Replace the gasket with a new one using rubber cement.

Ice jam

A strange thing happened not long ago. The coils of my new Amana thermostatically controlled dehumidifier iced up. The ice cleared up and the problem hasn't recurred. What can cause this?—Frank Burnett, Hartford, Conn.

I don't think there is anything wrong mechanically. This condition can occur if the "climate," so to speak, is just right in the area where the appliance is kept. Do you keep the dehumidifier in an unheated basement, for example? If humidity and temperature conditions are just right, the coils can ice up.

Maintenance Memos

● Hair and lint can in time ruin a refrigerator by accumulating on and clogging the cooling fins. This will cause the motor to run hot and burn out. Be especially careful if you

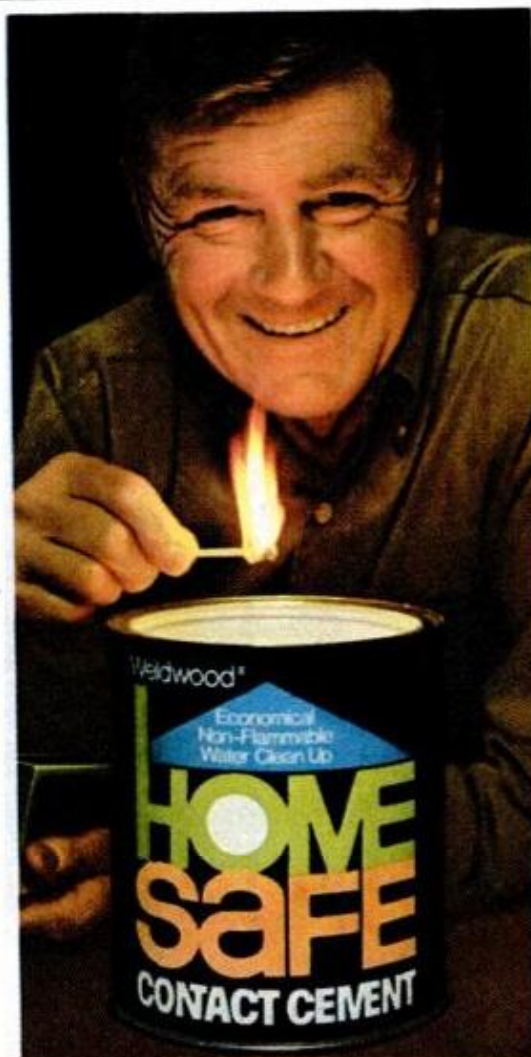
have a dog. The hair it sheds can lead to this problem. The preventive is periodic cleaning of the fins, using a brush attachment on your vacuum cleaner.

● Never take a chance with a bad appliance cord, especially when children are around. Where insulation is worn or broken, you may have a serious shock and fire hazard. Get a new cord.

● Don't forget that gears in gear-driven appliances, such as electric can opener and food mixers, need periodic lubrication, but with a special type of lubricant thin enough to stick to the gears and thick enough not to run. Most appliances require cream grease, which can be purchased in hardware and appliance supply stores. However, some manufacturers specify a special grease, such as silicone. If the instructions that come with the appliance don't tell what gear grease to use, write to the service department of the maker and ask. ★★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. However, problems of widest interest will be answered in this column.

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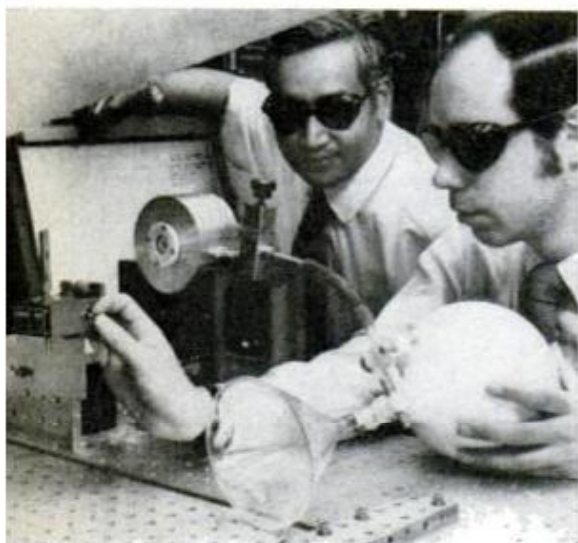
By JOHN PEARSON



GE researchers eye handiwork



Scientist-snooper outside Hydro-Lab



Bell Lab laser tags pollutants

DIRECT MAGNIFICATION of 1 million times—a record—was recently achieved by two General Electric scientists who used a specially modified electron microscope. The image can be enlarged still further through photography, as was done with the photo under inspection. Streaks in the picture—representing a magnification of 27 million times—show the location of planes of atoms in an aluminum-copper alloy. The GE technique is used to detect imperfections in metals.

IF YOU HAVE A FAULTY MEMORY, it may be because you remember too much. "The mind must set aside information it no longer needs to prevent it from interfering with new information," says University of Michigan psychologist Robert -A. Bjork, who has spent years in probing memory processes. "Consider the short-order cook. He not only has to keep track of the orders he's just received, but must also forget the one's he's filled. If he doesn't, his memory becomes cluttered to the point of paralysis."

A BOON TO MARINE SCIENTISTS, educational institutions and industrial organizations is the Perry Oceanographic Hydro-Lab, a five-man habitat located in 55 feet of water off Freeport, Grand Bahama Island. In place since last winter, the habitat is available (on a nonprofit basis) for research activities, and has been used by scientists from the University of Miami, Texas A&M and Westinghouse. First used in 1965 off Palm Beach, Hydro-Lab probably has recorded more "sea duty" than any other habitat.

WHAT LIQUID IS BEST for cleaning off bug residue, road oils and other gunk that fouls auto windshields? To find out, Virginia Highway Research Council technicians ran lab tests and made a survey of cleaning materials used at over 200 service stations. Conclusion: The most effective solution is a mixture of four parts wood alcohol, one part household liquid detergent and five parts water.

QUICK AND PRECISE IDENTIFICATION of small amounts of pollutant gases in air may become possible through the use of a technique devised by two Bell Lab scientists. Because individual gases absorb different frequencies of light from a laser beam, it's possible to "tag" them. Before the laser is aimed at a sample it is tuned to the particular frequency of a pollutant. Light energy absorbed by the gas increases the pressure of the air sample. The pressure, in turn, activates sensors that produce an electrical signal that can be read on a meter or cathode-ray tube. ★ ★ ★

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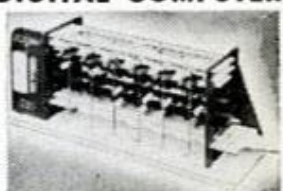
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DETROIT

LISTENING POST

BY ROBERT LUND

SMALLER-THAN-MINICAR APPROACHES being worked up for mid-decade are apparently different at GM and Ford. GM is targeting on a basic transportation vehicle—small, low initial cost, low operating cost. Ford may eventually go that route, but at present it's looking at a very sporty small car close to the current intermediates in price. This would indicate a starting price around \$3000.

Ford's also working on a car powered by natural gas, but probably just to keep its hand in because natural gas is in short supply in many parts of the country. The company hasn't confirmed this project, but suppliers participating in it have.

WHEN FUEL INJECTION COMES, it may cost a lot less than the estimates being booted around. When Chevrolet offered f.i. back in the '50s, the price was \$500 extra. But the art's been improved considerably since then and one major supplier to the auto firms believes an electronic f.i. unit can be brought out for less than \$75. But don't take that as the final word because it's the automakers, not suppliers, who determine prices.

THE WANKEL NEWSLETTER: How serious is GM about producing a Wankel? Enough to have asked for bids on \$12-million worth of tooling to put the engine into pilot production. This information doesn't come from GM but from suppliers close to the project. The same sources say GM will run off a sample batch of Wankels next year—1200 units.

Chrysler's a late starter in the Wankel sweepstakes, but the company's finally warming up to the idea. It's expected to take the Ford approach and shop for a Wankel connection overseas, try to tie in or buy in on a company already licensed to build the engine. But probably not in Japan. As long as Ford was cool to the rotary engine, Chrysler didn't feel any pressure to get into a Wankel program. But with Ford going gung-ho to catch up with GM, Chrysler's interested.

This won't be Chrysler's first experience with the Wankel. The company worked with Curtiss-Wright trying to develop the engine for a passenger car several years ago. C-W reportedly made Chrysler a proposition similar to the deal it now has with GM—pay X millions a year over a five or ten-year period for rights to use the engine

at the end of the contract. Chrysler declined the deal on two counts: (1) It thought the price was too high and, (2) it was too much of a pig-in-a-poke because of the problems that would have to be solved before the plant could be used in a car. But Chrysler engineers put in a lot of hours on the Wankel before GM and Ford came on the scene and Big C isn't far behind the other companies on preproduction work.

TWO REAL WINNERS may be in the lab at Bendix—if they can be turned out at the right price. The company's developed what it describes as a semimetallic material for brake linings—for both drum and discs—that could lead to life-of-the-car brakes. The firm has another project it's working out on a computer to produce an unvarying, ideal combination of fuel mixture and ignition to come up with an engine that literally tunes itself.

TIRE-PRESSURE ALARMS? Cadillac and Lincoln are looking at dashboard-mounted devices that alert the driver when tire pressure falls below the recommended level. Carmakers would like to put the equipment on all automobiles as a safety feature, but the price is too high. But as production volume increases, it may be possible to shave prices to a point where the device could be made standard industrywide. But that's a few years away. The unit Ford's looking at monitors air pressure in five tires—including the spare.

IF YOU'VE BEEN TRYING to sort out all the contradictory stories about what happens to the no-frame cars—Camaro and Firebird in particular—when energy absorbing bumpers become mandatory in '74, you're entitled to be confused. But you're not as mixed up as the auto writers who have been killing the cars off in print. How could so many experts be caught with their typewriters down?

The reporters are victims of a journalistic device known as the double no-scoop scoop. This is something like playing Ping-Pong with yourself—looks great if you can do it.

The easiest way to explain the double no-scoop is to tell you about Fred Fiction, undisputed master of the technique. Fred, whose real name was something else, covered Detroit for a weekly

(Please turn to page 42)



RECORD BUSTER

When you run nonstop for 24 hours to set a new world's record for snowmobiles . . . you've got to have spark plugs you can rely on.

That's why the Radmacher Marine Team used AC Sport Vehicle Spark Plugs. AC's hot tip heats fast, fires hot . . . helped deliver the smooth, steady power needed for the 984-mile record-breaking run.

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DETROIT LISTENING POST

(Continued from page 40)

trade magazine that was big on stories about
new factories going up—foundries in particular.
Fred never let them down. If there wasn't a new
factory in the works, Fred invented one. He gave
all the companies a turn, but was partial to GM.

Fred on the phone to GM: "What's this about
a new foundry going up in Saskatchewan?"

GM: "What foundry?"

That was enough for Fred. The next week he'd
be out with a story that "GM last week declined
comment on widely circulated reports that it
will construct a new \$6-million foundry in Sas-
katchewan." He'd wing it from there with fill-in
details on what the plant would produce, its size
and how many workers it would employ.

After the story appeared in print, GM would
be on the phone with an official denial. "You
mean it isn't so?" Fred'd ask incredulously. "You
know damn well it isn't so!" GM'd roar back.

This gave Fred his second shot. His story the
following week would lead off: "Reports that GM
will build a new \$6-million foundry in Saskatche-
wan are 'totally unfounded,' a company spokes-
man told X Magazine last week." He'd then
proceed to back out of the make-believe he'd
concocted the week before.

The trick of working the double no-scoop is to
get both the original story and the retraction in
print before other publications get wind of what
you're up to. But you have to be fast and do it
without tangling your feet in the net as you bat
the Ping-Pong ball back to yourself.

To get back to Camaro and Firebird, it's like
we said in this space in July—the cars will be con-
tinued. The '73 versions won't be much changed
from the '72s. What we didn't know in July is
that the cars will be completely reworked for '74,
they won't be as sporty as the current Camaro
and F-bird and they'll be lower priced than the
'72/'73s. And that's laying it on you straight.

What happened to Fred Fiction? He took the
cure. One of the auto companies (not GM) figured
he'd cause less harm if they had him on the pay-
roll. They hired him as a public relations man
and shipped him overseas.

DETROIT ISN'T FIGHTING as it used to when the
government comes up with standards for cars.
It's because more and more states are starting to
write requirements peculiar to their own areas. The
auto companies don't want to get into building
Montana-only, California-only, Vermont-only cars,
so they're more willing to go along with Federal
legislation because it supersedes the state
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PM-58

Drivin' with Dan

Why do NASCAR rules differ for some wedge engines? What speed limit would you set for the interstates? Why are such wide tires installed on race cars? Dan Gurney answers these and other automotive questions

Q. In the new NASCAR rules, can you tell me why the Ford wedge engine must run with the handicap of a smaller carburetor throttle plate opening than the Chrysler wedge? They're the same type of engine with almost identical displacements of 427 and 426 cu. in., respectively.—*Jake Reichert, Owosso, Mich.*

A. As far as I know, this was a decision made by NASCAR boss, Bill France, in an effort to make the races closer. Apparently, he felt the Ford wedge had an advantage and, with factories backing out of racing, hoped to equalize the competition among the various racing teams, large and small, driving a wide variety of cars. As this is written, by the way, news comes from Atlanta that the Wood Brothers are garaging their Ford-powered cars in protest of the rule, which they believe unfair. The opening on the Chrysler wedge plate is $1\frac{5}{8}$ inches; that on the Ford wedge, $1\frac{1}{2}$ inches.



CARBURETOR PLATE must be installed on engines competing on NASCAR Grand National Circuit. The holes being checked here with a go/no go gauge restrict fuel/air flow to cylinders. Varying size of holes required by rules for different manufacturers' engines have led to protests from the competitors

Q. What problem do you attack first when preparing an Indianapolis car—trying to make it the fastest car or to be as sure as possible it will finish?—*Bernie Brettinger, Eugene, Ore.*

A. What is the saying? First you must finish before you can finish first. Of course it is more difficult than that. If you concentrated only on finishing, you probably wouldn't qualify! Anyway, we do our utmost to make the best compromise. We still go there to race. This year we finished fourth with one of our Olsonite Eagles, Jim Malloy driving; Bobby Unser, in the other one was knocked out in a crash.

Q. What do you think the speed limit should be on interstate highways?—*Calvin Roosevelt, Peoria, Ill.*

A. It should depend upon the type of vehicle, its load, the weather, etc. An 80-mph limit is quite safe for many cars and drivers, but can be lethal for others. A 75-mph limit is a realistic compromise, but driver judgment is always much more important than speed limits!

Q. Can you explain why racing cars have such wide tires? According to physics, the traction force is independent of the tire footprint. Under the same weight, the wider footprint results in the same traction because the load-per-square-inch is proportionally less and the friction coefficient is constant.—*J. Botari, Hamburg, N.Y.*

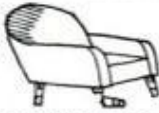









A. When we run tires to their limits as is done in racing, we find that the problem is a bit more involved than the physics book leads you to believe at first glance. Heat is the big enemy of a tire in racing. When you start working a small tire patch, it generates more heat than a larger one; it will get too hot, begin to go liquid or fail sooner than a

(Please turn to page 50)

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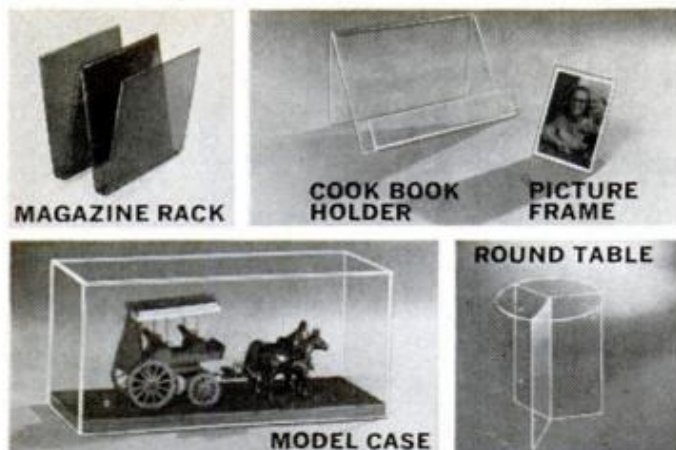
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DRIVING WITH DAN
(Continued from page 48)

larger-patch tire which spreads the same heat load over more area. Larger tires generally run cooler and, therefore, often can use rubber compounds that have better traction but are more vulnerable to heat.

Q. I know you have won more Grand Prix races than any other American driver, but I keep seeing different numbers. How many was it, Dan?—Danny Chamberlain, Jacksonville, Fla.

A. Four full-fledged GPs: the French twice—1962 in a Porsche and 1964 in a Brabham; the Mexican in 1965 in a Brabham and the Belgian in 1967 in an Eagle. I also won a Formula 1 race with a B.R.M. in Australia in 1960; a big F-1 race with a Porsche in Germany (the Solitude circuit, 350,000 spectators) in 1962 and another F-1 race with an Eagle at Brands Hatch in England in 1967 (and almost all of the good guys were there, too!)

Q. Why aren't Chevrolet engines used much in Top Fuel drag racing?—Don Riccinti, Madison, Conn.

A. The hemi-headed Chrysler engine seems to be better for the job of getting off the line. On the other hand the Chevys have dominated most track and road racing.

Q. Do all racing cars use tubeless tires? When they are used, is it because they are safer?—V.R. Ventura, Riverdale, Ill.

A. Most Indy cars, Grand Prix cars and Can-Am cars use tubeless tires. They are lighter, run cooler, and are generally faster and just as safe for this type of racing. NASCAR stock cars—which punish tires unmercifully because the cars are so heavy and race on banked speedways—usually run on an inner liner which is almost a tire within a tire. Hardly any of the folks use tubes any more.

Q. I'm 19, have raced go-karts and my Mustang in auto-crosses, and have a friend who says he'll let me drive his sprint car when I'm ready. I'm thinking of buying a micro-midget (motorcycle engine), which is all I can afford. Do you think this approach will prepare me for a sprint car?—Allan Chaput, Fresno, Calif.

A. It will certainly help, but I can't think of
(Please turn to page 52)

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Von Schrader Upholstery Deterger. Gives deep-level cleaning to fabric upholstery and synthetics.



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bucket-and-sponge method. Cleans easily without any mess.

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DRIVIN' WITH DAN

(Continued from page 50)

anything that will really prepare you other than a sprinter itself. Learning to understand the engineering and vehicle dynamics of a micro-midget and/or a midget or any other four-wheel vehicle will be a help. Learning good judgment under the heat of battle is probably as important as pure driving skill.

Q. I've seen pit crews spill gas on the car during a pit stop. Do you think that they mean to do this or is it a danger?—Paul Cloniger, Lewiston, Idaho.

A. It is a danger and it is also intentional: It is about the only way the crews have been able to devise so far to tell when the tank is full.

Q. I think racing is great, but it seldom is as good on television as in person. What do you think could be done?—Pauline Godfrey, Kansas City.

A. The television coverage of sports is improving all the time. I think that more knowledgeable announcers would help a great deal, but they, too, are also improving all the time. I believe that this is one of the things that takes time. More constructive criticism from viewers would be helpful. Maybe a magazine could conduct a viewer survey and then publish the results.

Q. My ambition is to be an automobile designer for Ford Motor Co. What, in your opinion, would be the best way to go about this? (I'm 12 now.)—Greg Halling, Leavenworth, Kans.

A. In my opinion, I doubt that it matters at this stage whether you intend to work for Ford or some other large company. I would write its design department personnel or employment offices and ask them for suggested courses of study. I don't know if you are leaning toward styling or engineering, but I do believe you should read everything about automobiles you can get your hands on and then apply for a summer job as an apprentice. ★★★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 18).



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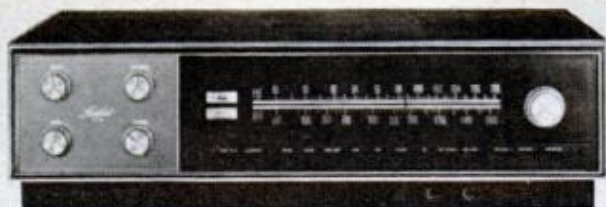
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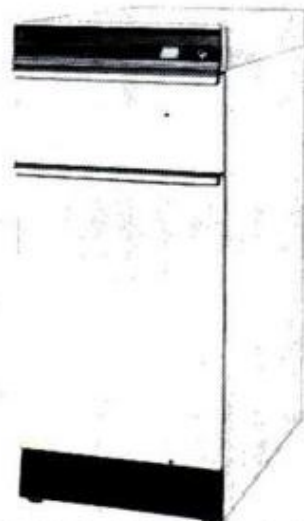
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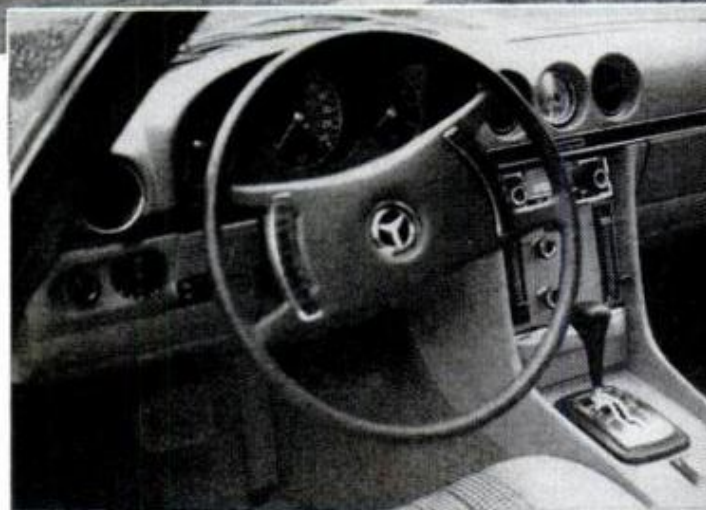


The new Mercedes-Benz 350SL is proof that speed, style and safety can be combined in one car

By BILL HARTFORD, Auto Editor

AN OVERPOWERED MUSCLE CAR it's not. A knee-high Italian GT it's not. A government safety car it's not. It is a motor car with an extraordinary balance of performance, style and safety. A car that embodies the Mercedes magic: design first for function and watch the graceful form unfold!

The function of this successor to the 280SL, now out of production, is simply moving two people swiftly, safely and comfortably over roads good and bad. Designing most production touring cars to do this job involves compromise—sacrificing something, mostly in the interest of economy. But imagine being an engineer on the 350SL and hearing the boss conclude his instructions: “. . . and bring it in under ten!” Ten thousand dollars is the approximate sticker price on the 350SL that should, by now, be in all Mercedes showrooms. Without cost to fret about, an engineer doesn't have to



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compromise much in designing the best car he can. There are still a host of parameters to live with: available materials, production processes, design weight, serviceability . . . *ad infinitum*. But no \$3995.95 sticker price to shoot for.

I got my driving impressions of the car at the famous Hockenheim road-racing circuit near Mercedes headquarters in Stuttgart. After a few laps I felt as if I had been driving the car for years, and was confidently running the circuit's long straight at 200 kilometers or about

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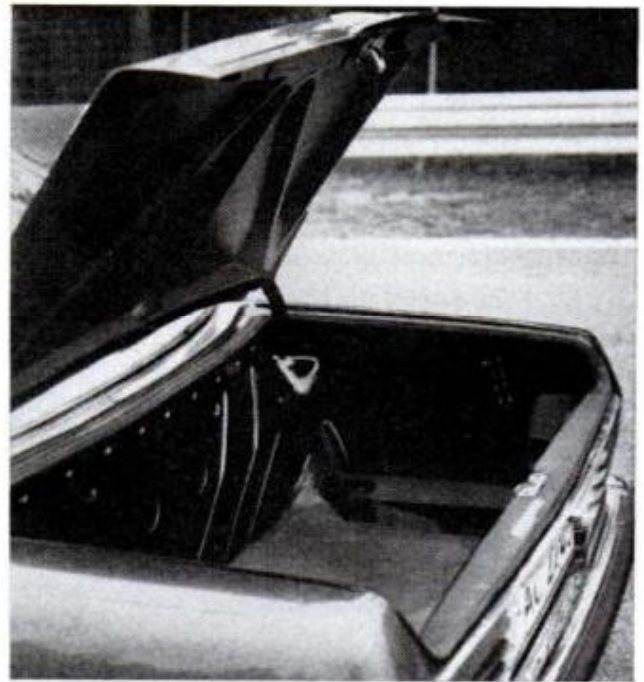
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STYLING CONTINUITY indicates the 350SL is without a doubt a Mercedes. Pagoda-type, detachable hardtop reflects heritage in the discontinued 280SL model. Car also has a soft top that can be folded out of sight

124 mph, close to the top speed of the car. I was soon equally confident of the coupe's stopping performance, and I began going deeper into the turns before braking. The big disc brakes are power-assisted front and rear and the fronts are of ventilated design. The acceleration (smooth, not sizzling) and top speed of the 3.5-liter, automatic-transmission European version I drove is essentially the same as that of the U.S. model—even though the latter will have a larger, 4.5-liter V8. The power from the extra liter is drained off running (you know what) emission controls. A little less fuel economy perhaps, but performance has not been compromised.

And without compromising safety, the pagoda-roofed 350SL is also available in soft top without roll bar. That's possible since the windshield pillars do the support job in a rollover! Their cross-sectional shape was determined by plugging into the computer all possible stresses on the members. The result is a strong pillar,



TRUNK SIZE is large, benefits from fuel tank being moved forward over rear axle out of harm's way

**SPECIFICATIONS:
MERCEDES-BENZ 4.5 350SL**

DIMENSIONS AND CAPACITIES:

Wheelbase: 96.9 in.	Track f/r: 57.2/56.7 in.
Length: 172.1 in.	Weight: 3400 lbs.
Width: 70.5 in.	Fuel cap.: 24 gal.
Height: 51.2 in.	Trunk cap.: 8.9 cu. ft.

ENGINE

Type: Water-cooled 90° V8, single-overhead-cam
 Displacement: 4500 cc (276 cu. in.)
 Horsepower: 230
 Carburetion: Bosch electronic fuel injection

TRANSMISSION

Three-speed automatic, torque converter

SUSPENSION AND STEERING

Front: Unequal length A-arms, coil springs, tube shocks, antisway bar
 Rear: Semitrailing arms, coil springs, tube shocks, antisway bar
 Steering type: Power-assist recirculating ball

BRAKES AND TIRES

Brake type: Power-assist discs, front ventilated, rear solid
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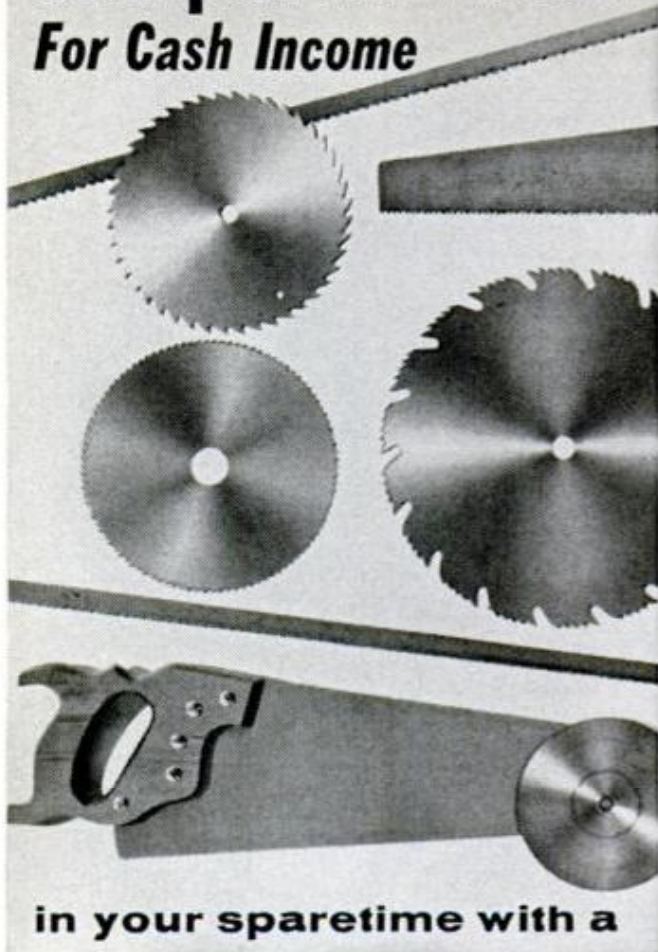
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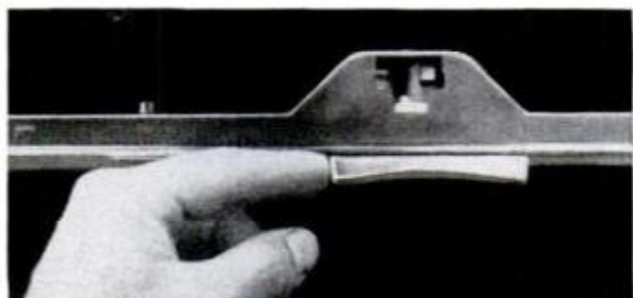
350SL ENGINE is a 276-cu.-in. V8, takes unleaded fuel. Automatic transmission and air are standard

thin enough not to block visibility, raked back at a smart angle, and having a built-in trough that carries rain and road dirt up and over and keeps it off the side windows.

Aerodynamics is also a factor in design of the "corrugated" sheet metal along the lower body sides and similar, slotted taillamp lenses: It minimizes accumulation of road dirt which, in the case of the taillamps, decreases their nighttime visibility.

Safety inside the car includes defogging of *all* windows; side-view mirror (breakaway type) adjustable from inside the car (of course, Mercedes isn't the only manufacturer to offer this seemingly petty but terrific safety and convenience item); and seat belts (on inertia reels) attached to the hand-sewn leather bucket-seat frames so they always fit without fuss. There's much more to the 350SL story and the pictures and captions only tell some of it.

Quite a car. Quite a price! It's too bad that most of us, shopping for more commonplace machines, will have to compromise! ★★★



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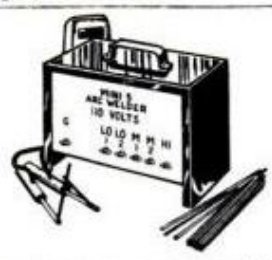
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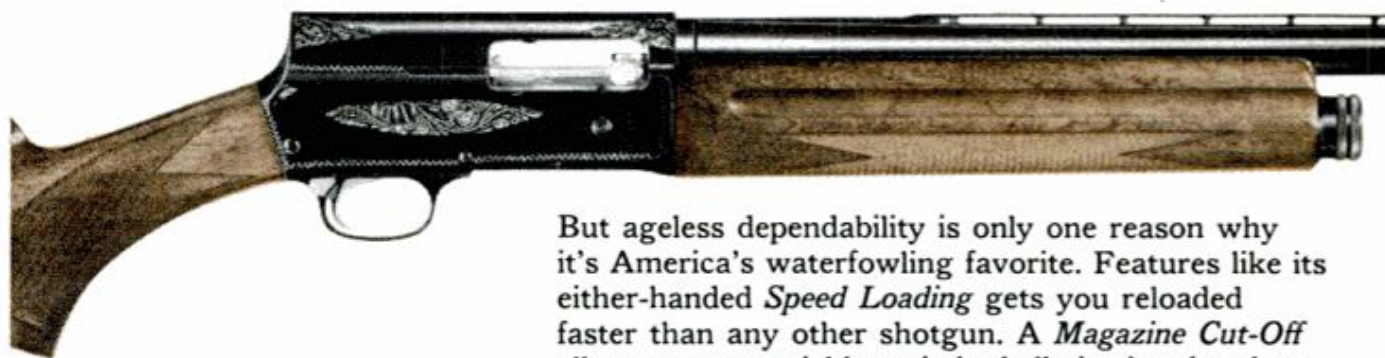
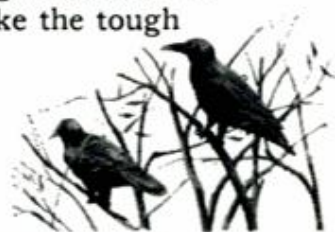
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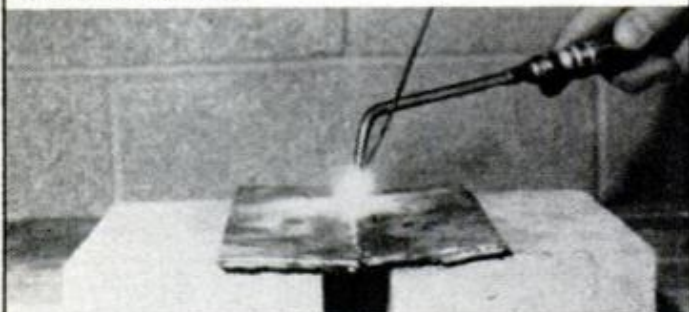
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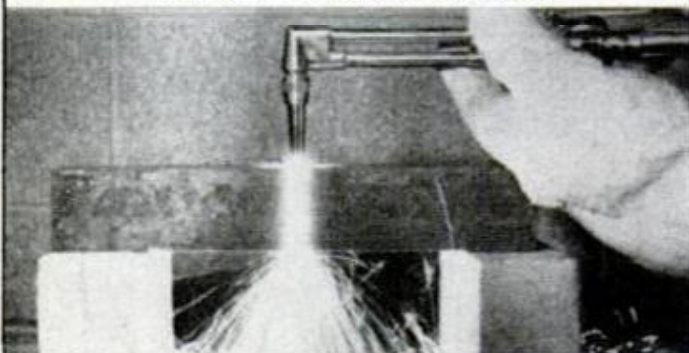


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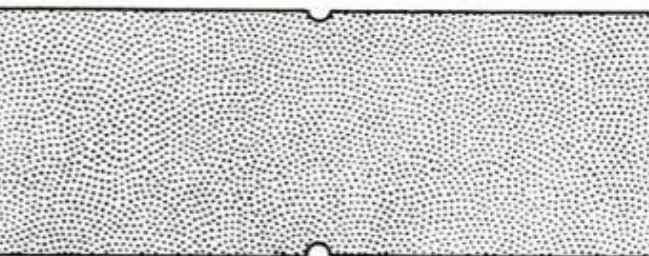
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NRI announces a dramatic new way to learn Automotive Repair at home

Top auto experts praise NRI's new training plans

After more than two years of preparation, NRI has made available two new home training programs in Automotive Servicing and Repair, acclaimed by experts as "amazingly complete" and "up with the times." NRI asked two of America's foremost automotive experts to critique its new program. William H. G. France, president of NASCAR and the International Speedway Corp., reported, "The new NRI courses for mechanics are amazingly complete and seem to cover all major aspects of today's sophisticated cars. If you're at all interested in automotive training, I suggest you investigate NRI." Car-tester/writer Tom McCahill was equally enthusiastic. "I've been around cars since bathtub gin, and I've never seen home training for mechanics as great as this."



Professional equipment included at no extra cost

NRI gives you the choice of Master Automotive Technician training or a shorter Automotive Tune-Up and Electrical Systems course for the man seeking greater understanding of basic car repair. The Master course covers every major aspect of auto repair, from changing spark plugs to operating your own garage or car-care center. You not only learn the how and why with NRI's proved-in-use "bite-sized" texts, but you also get professional training equipment you need to actually do the work on your own or other cars as you move along in your home training. Equipment you get — at no extra cost — includes your own ignition-analyzer scope, as well as a dwell-tachometer, timing light, complete set of tools,

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The same pioneering home training methods and innovations which have made NRI the leader in other career training fields are now offered to ambitious men who want to turn their interest in cars into a solid, well-paying career. Take a tip from Tom McCahill and Bill France and train at home with the leader. Rush coupon now for free NRI Automotive Catalog. NRI AUTOMOTIVE DIVISION, Washington, D.C. 20016. No salesman will call.

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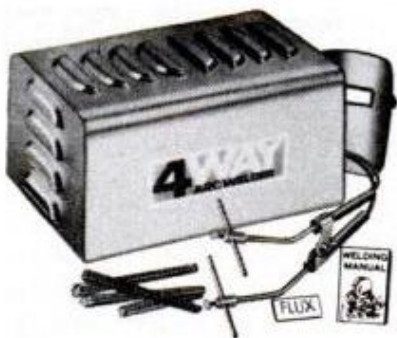
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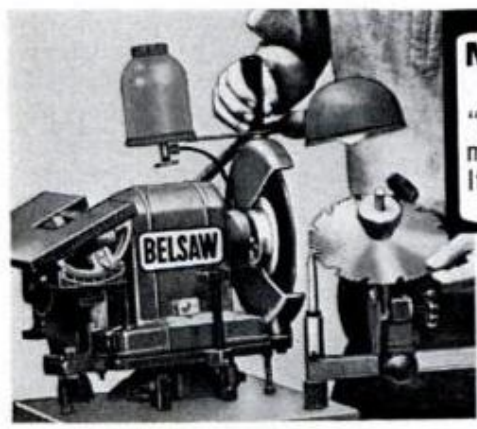
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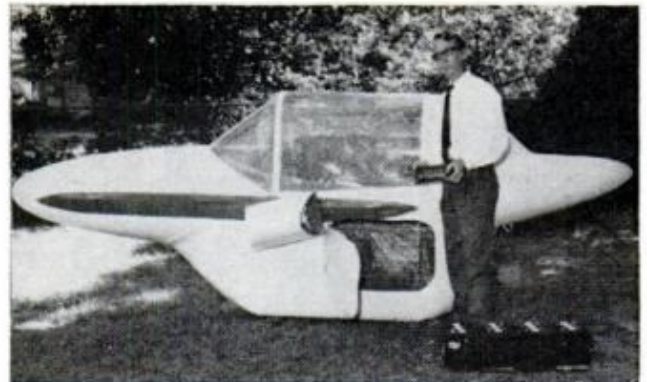


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Saga of PM's submarine

Built in Florida by Kent Markham (top photo) PM's Two-Man Sub (cover story, June PM) traveled by Red Ball van to New York where it appeared on the David Frost Show during the summer. Shortly afterwards, PM donated the craft to Windward Oceanography Institute, Rowayton, Conn., where it's now exploring Long Island Sound.



Homemade hydraulic lifter

The 27-inch rise from sidewalk to porch was too much for Herbert Lincoln of Lombard, Ill., to manually raise his wife and wheelchair. He hit upon the bright idea of burying a hydraulic cylinder and using it to activate a piston. Now he simply stands to one side and operates the controls to lift his wife.



Karen's Franklin runs. Beautifully.

Two years ago, Karen Doane saw a 1932 Franklin. She loved it. But the car was sold before she could raise the money to buy it.

Last year, Karen found another 1932 Franklin.

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She drives it to school. And she redecorated the interior.

Happily, she found a mechanic, Guy Roese, who knows all about Franklins.

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THE SECOND HOME is the title of a new full-color idea and planning booklet featuring homes ranging from vacation retreats to primary residences. Thirty designs, several expansible, are shown. The booklet includes a Plan-Order Form and price schedule. It's available for \$1 from Western Wood Products Assn. Dept. 542-L, Yeon Building, Portland, Ore. 97204.

IF YOU have questions regarding refrigeration and airconditioning controls and systems, you'll be interested in the *Refrigeration and Air Conditioning Service Handbook*. It outlines basic systems and circuits and provides information on the application, checkout, service and replacement of controls. A troubleshooting section helps locate and service problems. Available for \$1 from Honeywell, Minneapolis, Minn. 55408.

ON YOUR NEWSSTAND now is PM's all-new 1972 edition of *Better Ways to Do It*. Includes ideas galore for sportsmen, homeowners, car enthusiasts, electronic buffs and more. It sells for \$1. ★★★

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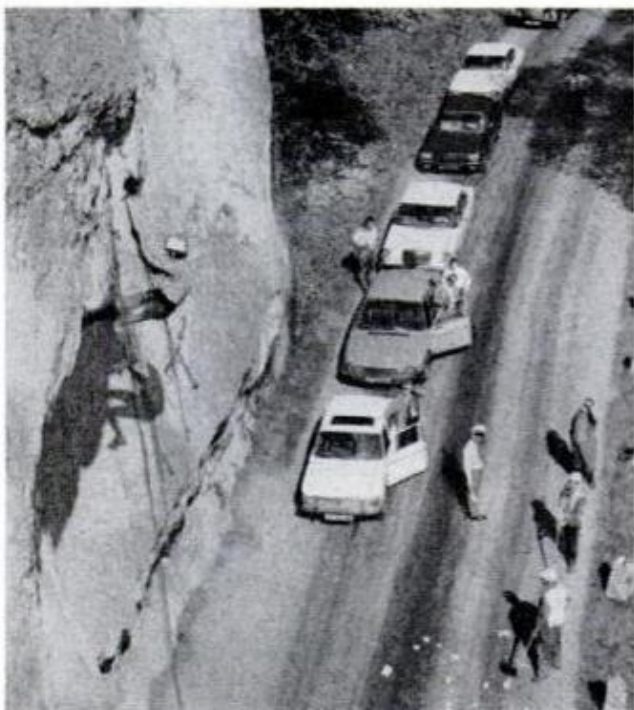
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NEWS BRIEFS



Ceramic with great promise

A new transparent ceramic material developed at the Honeywell Ceramic Center may have some unusual applications, according to researchers. This one-inch-square, .005-inch-thick chip could be the picture tube of a tiny television set or a 2-million-bit computer memory, they say.



Rolling stones

Every June, members of German mountain-climbing clubs are employed by the Highway Construction Dept. to test cliffs that overhang highways for dangerous rocks. Any that have been loosened by freezing and thawing are removed, lessening the danger for motorists.

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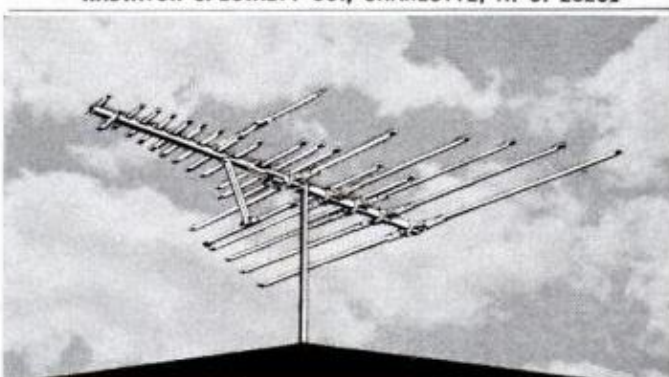
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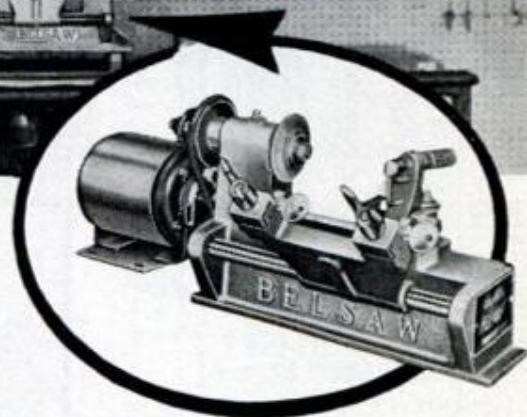
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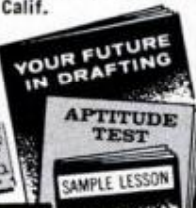
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POLLUTION FIGHTERS'

NEWSLETTER



"ONLY ONE EARTH" is the motto for the United Nations Conference on the Human Environment scheduled for June, 1972, in Stockholm. The symbol for this first world meeting is that of man surrounded by his earth, encircled with a wreath of laurels—the U.N. peace symbol—to show man as part master, part creature of his environment. The emblem was created by Robert Perrot of the U.N. staff.

REALIZING THE IMPACT the Stockholm conference can have on international environmental action (1200 government officials and advisers from various countries are expected), the Ford Foundation has granted \$236,560 to six committees composed of international scientists who'll present their studies and recommendations at the conference:

- \$79,000 to the Special Committee on Problems of the Environment (SCOPE) of the International Council of Scientific Unions (ICSU) for a six-month study to design a worldwide system to measure substances in the environment that adversely affect man's well-being.
- \$25,000 to the Massachusetts Institute of Technology for study on the effects of man's activities on climate.
- \$14,500 to the Committee on Water Research of ICSU for a symposium on man-made lakes.
- \$20,300 to SCOPE for a two-month follow-up study of man-made lakes to prepare recommendations for international research.
- \$20,000 to the Smithsonian Institution for three years' general support of the International Council

for Bird Preservation to investigate the effect of pesticides.

- \$77,760 to Columbia University to test the possibility of compiling an international register of chemical compounds, with information on their possible damage to the environment.

TO DEMONSTRATE THE SUCCESS of environmental protection in Sweden, Norway and Denmark, Scandinavian Airlines has designed a unique air tour. Travelers can select from several workshop itineraries from 7 to 15 days. In Stockholm, Oslo, Copenhagen and in intermediate rural and industrial locations, participants can observe the Scandinavian approach to:

- Air and water-pollution control in such industries as pulp, paper, steel, chemical, food;
- Garbage collection by vacuum tube—the Automatic Vacuum Collection System (AVAC is now being installed at Disney World, Fla.; see page 94);
- Solid waste collection—the Sellburg system of collection from summer houses and marinas by boats equipped with compaction units;
- Revitalization of polluted lakes;
- Noise abatement;
- Planning community and industrial development.

For more details write: Environmental Control Workshops, Scandinavian Airlines, 138-02 Queens Blvd., Jamaica, N.Y. 11435.



THIS SYMBOL—"Contains Recycled Materials"—is now available from the National Assn. of Secondary Materials Industries to manufacturers using "meaningful" amounts of recycled materials in products. NASMI (330 Madison Ave., New York, N.Y.) created the seal for quick identification of a product made of recycled materials. A paper product, for instance, qualifies by meeting the following standards: printing, stationery, grade products must have a minimum of 25 percent recycled paper; tissue, toweling and related products, 25 percent; corrugated containers, 90 percent; boxboard and other paper, 90 percent. NASMI says the seal can be obtained for other products if the manufacturer shows that the product has a substantial recycled content. ★ ★ ★

Presenting the case against rough weather:



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100 pocketproof powerful "golden" 22 long rifle cartridges in a specially designed plastic case that really earns its keep... even when it's empty.

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hunting shirt or jacket. The lid of a "Power-Pak" slides back with a series of positive "click" stops

... you can dispense 5 cartridges (or 10 or 15 or however many you need) without fumbling with loose cartridges or packages that are more than a handful. And when the "Power-Pak" is empty, just flip the tray out, and you've got a great place to keep small spare parts, larger cartridges, trout flies, fishing lures, whatever

needs keeping. We think the "Power-Pak" is right on target... worth looking for wherever you buy your ammunition.

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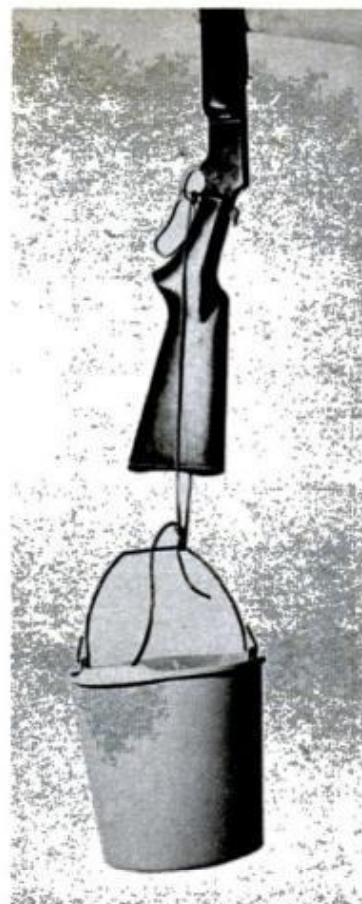
"Power-Pak" and "golden" are trademarks of the Remington Arms Company, Inc.

HUNTING TIPS



Smart way to cross fallen timber

If you shoot from the right shoulder, you should step over every log and obstruction with your left foot first. That way, if game flushes, you are ready and in correct shooting stance. However, *never* try to go over a fence ready to fire. Too many guns go off while hunters are between strands of barbed wire.—*Lefty Kreh, Miami*



How to test your trigger pull

Any trigger pull over six pounds is too hard and will affect most gunners' accuracy. Any pull under three pounds is dangerous. Any roughness or jump during pull is equally unsafe. To check, tie a cord around the trigger of your gun and gradually lift known weights. Use an expended cartridge in the chamber to cushion the firing pin during these tests.

—*Calvin DeViney, Miami*



Putting your game away

Some hunters take their jackets off to do the job, but the easiest way to insert game in the pouch of your hunting coat is to slide one hand through the coat back, grasp the bird by the head and pull it into the pocket.—*Lefty Kreh, Miami*



Budget shotgun sight

Many well-populated states or counties insist upon shotguns and buckshot for their deer hunting. A 10 or 12-mm fishing-rod guide taped to your gun's receiver will aid considerably in making better shots.—*Lefty Kreh, Miami*

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Friends don't come much more reliable than the Opel economy wagon.

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engine is friendly, too. Hydraulic valve lifters help keep it quiet while they cut down on the need for adjustments. Opel's kind to bodies too. Stabilizer bar and rear coil springs are combined in the suspension system, and the contoured front bucket seats have adjustable backs.

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New tools you should know about



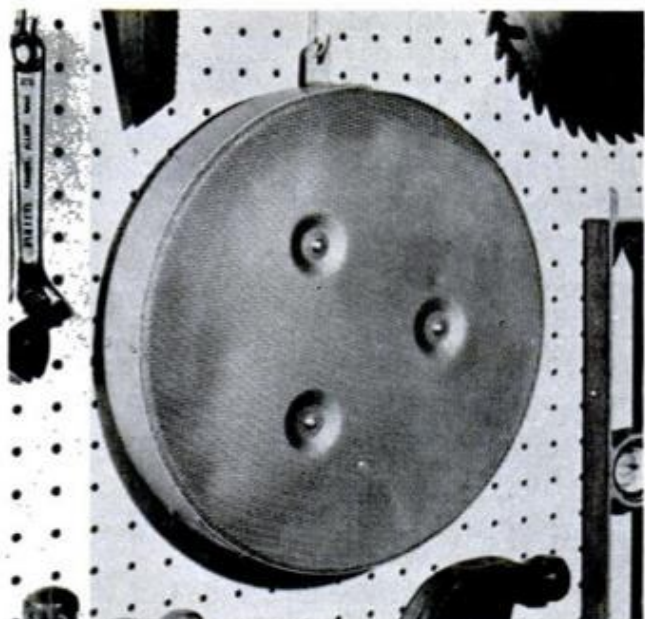
SAW SQUARE makes it easy to crosscut with a portable saw. A hooks onto board end, B gives measurement, C is a magnified view of ruler, D is for saw blade offset. About \$10, KMPPS, Taylorsville Rd., Jeffersontown, Ky.



ONE-ARM PAPERHANGER is the name Hyde Tools, Southbridge, Mass. 01550, gave this three-in-one wallpapering tool with a flat maple roller at one end and a casing and corner knife on the other. At hardware stores, \$3.15.



CENTER PUNCH SET from General Hardware, 80 White St., New York, N.Y., comes in handy container and is sold through hardware stores for \$7.90. Set No. S-73 includes seven punches needed for most drilling operations.



MOISTURE ABSORBER is a self-contained, portable unit that can be used over and over after reactivation in an oven. Indicator tells when to bake it. \$20. One-Way Industries, 47 Spindle Ave., Little Falls, N.J. 07424.



PLASTIC MALLETS claimed to be unbreakable boast heads that are cross-pinned to hardwood handles. They're priced at \$2.50 to \$5 and sold at hardware stores. Roscoe Products, Smithtown, N.Y. 11787 is the maker.



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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Vent area for crawl space

How can I estimate the proper vent area in a crawl space?—P.T., Okla.

The FHA says: "At least 4 foundation wall ventilators shall be provided, one located close to each corner of the space, having an aggregate net free ventilating area not less than 1/150 of the area of the basementless spaces . . ."

Removing stain from marble

How can I remove a yellowish stain from an old marble tabletop? I don't know what caused the stain but it looks like rust.—D.R., Idaho

Removal of stains from old marble seems to be an increasingly common problem and for this reason I'd suggest that you contact The Marble Institute of America, Consumer Service Dept., Pennsylvania Building, Washington, D.C. The Institute can supply you with a kit for the removal of most common stains. Present cost of kit and instructions is \$5.50 postpaid.

Furring-strip locator

I want to find the studs in a plastered wall so that I can locate horizontal furring strips. I've heard of something called a "dowser" or "dowser ball." Is there such a gadget, or whatever, and where can it be obtained? Does it work?—T.A., Ohio

Yes, there is such a gadget and it's said to be quite effective. I use a hammer, tapping the wall lightly, determining the location of a stud by the "solid" sound rather than the "hollow" sound given off in the spaces between studding. The so-called dowser ball is available from Albert Constantine & Son, 2050 Eastchester Rd., Bronx, N.Y. 10461.

'Sawing' glass bottle

I have an old glass bottle about 4 in. in diameter and 15 in. tall, including the neck. I want to break it just above the halfway point. Can this be done? How?—P.D., Mich.

You don't break it; you saw it. Mark

around the circumference at the point you want the cut to be made with a grease (china-marking) pencil. Then buy a carbide-coated blade (called a rod saw) for your hacksaw and clamp the bottle lightly in a vise with jaws that have been padded with pieces of old carpet. Cut through carefully on the penciled line, turning the bottle as you go and being sure not to heat the glass unduly.

Incidentally, if your bottle is very old, I'd have it appraised before you attempt to cut it. Certain old bottles are quite valuable.

Desert-dry air in rooms

Why does air in my home dry rapidly when I start my furnace in the fall?—W.H., Wis.

Is your furnace humidifier working properly? It should be checked before the start of the heating season. If it's clogged or coated with lime and other deposits it should be put in working order. If it's of the type having a float-controlled valve a tablespoonful or two of white vinegar added to the water will help to break up hard deposits. Add it to the water in the pan.

Stated simply, when you heat the air in a closed structure it acts as a sponge, absorbing water (moisture) from everything with which it is in contact. The moisture is dissipated by the constant exchange of warm air from inside with the colder, drier air outside through walls, windows and doors.

Renewing gilt frame

I have an old oval picture frame with a liner in gold leaf. How can I clean and brighten the leaf to make it look somewhat like it did originally?—C.F., Md.

I'd clean the dust and debris from the liner first. Use a mild soap and warm water, applying the solution with a swab made by twisting a ball of cotton onto a toothpick or other small sliver of wood. Be careful not to wet the liner unduly. Dry the liner immediately following this treatment, using a ball of undampened cotton.

With this treatment, the gilding should regain at least some of its original brilliance. If there are pits that still dull the liner you can go a step farther and apply what is commonly known as "wax gilt," a product that's available from your local paint dealer or art store. Apply it with a fingertip and burnish according to the instructions. ★★★

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Cunningham

King Size, 18 mg. "tar," 1.4 mg. nicotine; Long Size, 19 mg. "tar," 1.3 mg. nicotine
av. per cigarette, FTC Report Nov. 70.

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Disaster at Hurricane Creek

Popular
Mechanics



There had been ominous warnings at the Hyden, Ky., mine—one man blinded, another crushed to death. But work went on. Then—at 12:20 p.m., Dec. 30, 1970—the mine exploded!

By **STEVE BACON** / Illustrations by Roy Grinnell

IT WAS A COLD, GRAY DAY in eastern Kentucky when disaster struck. The site was a coal mine tunneled into the base of a mountain located four miles east of the town of Hyden and along a fork of Hurricane Creek. The time was 12:20 p.m., Dec. 30, 1970—one year to the day after the new Federal Coal Mine Health and Safety Act had been signed into law.

A blast deep within the mine ignited coal dust. The resulting explosion ripped through long, dark passageways, leaving death and destruction in its wake. Those on the surface had little warning—they felt no tremors and heard only what one man described as an “ungodly roar”—before the guts of the mine spilled out of its eight openings.

A.T. Collins, whose job was to oversee the half-mile-long conveyor that

carried coal out from the mountain, had just eaten his lunch and was heading back into the mine. He caught hot debris in his face, then felt a pain shoot through his body as a steel roller from the conveyor smashed into his back. The windstorm ripped his coveralls, tore his watch from his wrist, and picked him up and hurled him some 60 feet, leaving him dazed in the middle of a road.

The breath knocked out of him, Collins raised his head from the roadbed only to feel mine timbers, coal, dust and other debris fly overhead. He clung to the trembling earth, hands over his head, until the storm subsided. Though his eyes were caked with dust and his vision blurred, he remembers seeing mine operator Charles Finley running to cut off the high voltage that fed the mining machinery and then found himself and Finley working with desperate speed to get fresh air down to the men trapped below.

Small-scale mining is a simple operation. You just lease rights to the coal, tunnel in horizontally at the base of a hill, blast out the coal with explosives and haul it to the nearest railroad. The seams of coal around Hyden are anything but generous—29 to 36 inches thick—and entrances to these mean holes in the ground aren't much higher. They take special low-slung mine tractors and trailers less than three feet high.

That was how the Finley mine—really two interconnected mines—was



worked. Some 100 men on three shifts could earn \$24 a day in a part of the country that offers few other jobs. And the mine was safe, or it should have been, for the new federal law carefully spells out high safety standards.

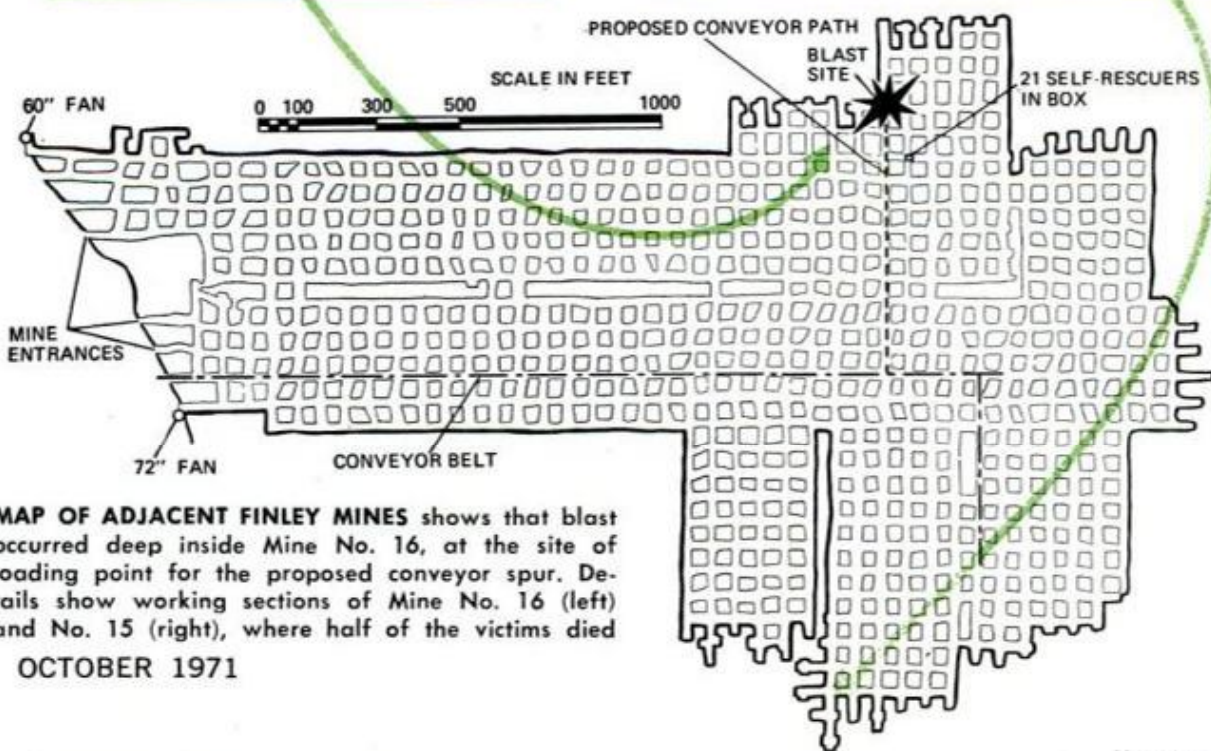
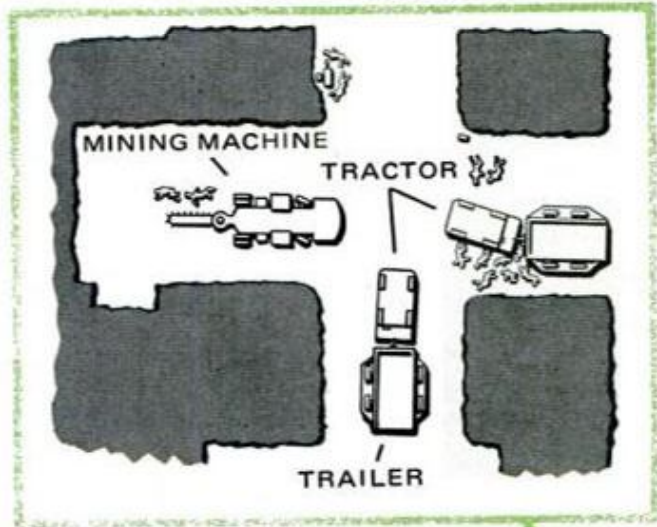
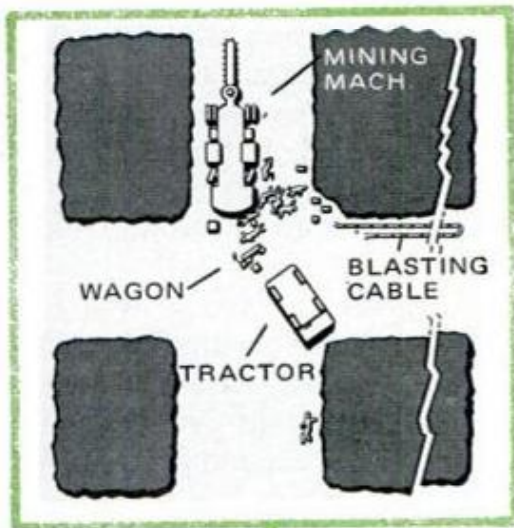
Coal mining is among the world's most dangerous jobs. Dry coal dust is highly explosive; so is the methane gas given off in some mines. It was methane that triggered the 1968 Farmington, W. Va., disaster that killed 78; nine more died that year from a coal-dust explosion in Kentucky. Smoking in mines—or making any sort of flame—is strictly prohibited. Although man-made explosives are used for blasting coal and making rooms high enough for mine machinery, the exact types and their use are closely prescribed by the U. S. Bureau of Mines.

Aside from explosions, miners are killed in roof falls, by gas pockets, by floods, in electrocutions and machinery accidents. Some 255 died in 1970, and the new law was intended to cut this grisly toll.

Despite the law, however, there had



RECOVERY CREW ENCOUNTERED roof timbers, power cables, pieces of primer cord inside mine



MAP OF ADJACENT FINLEY MINES shows that blast occurred deep inside Mine No. 16, at the site of loading point for the proposed conveyor spur. Details show working sections of Mine No. 16 (left) and No. 15 (right), where half of the victims died

OCTOBER 1971



HOURS AFTER THE EXPLOSION bodies of several Kentucky miners killed in the Hurricane Creek disaster are being brought out on low-slung mine trailers, normally used to haul coal from working area to loader

been a series of accidents at the little Hyden mine. Some four months earlier one man lost his eyesight and a second suffered cuts and a ruptured eardrum. The evidence points to careless handling of explosives.

On that hot Aug. 12, Rufus Whitehead and his assistant, Mack Collins, were wrestling their big mobile drill—used to drill shot holes in the coal face—from one location to another. The machine snagged on a high spot in the floor and its high-voltage power cable caught between it and the drill frame. With another tug, the frame bit into the cable itself, and an arc of electricity shot through the air, igniting coal dust and drill lubricants.

After the power was shut off, Collins and Whitehead went back to the drill and covered it with rock dust—actually powdered limestone—which is used to keep coal particles down, prevent explosions and reduce the danger of “black lung,” a common illness of miners.

The fire had spread to a piece of inner tube on top of the drill carriage, and they pushed it onto the floor and doused it with dust. That done, they settled down to wait for the repairman. A sudden explosion ended the silence.

Pieces of the drill, coal and other debris flew into Whitehead’s face, chest and right arm, blinding him instantly.

Although the hydraulic hoses leading to the drill may have been a factor, the best guess pointed to the contents of the inner tube. Against regulations, it may have held detonators and explosives.

There *was* danger and it was terribly, horrifyingly unpredictable. Three months after the drill exploded, yet another accident foretold eventual disaster. Twenty-four-year-old Charlie Wagers had been a miner for three years. On the evening of Nov. 9 he was driving a battery-powered tractor towing a trailer loaded with coal. “When I put it in forward it goes backward,” he had told repairman Kenneth Morgan. Twice Morgan had cleaned built-up coal dust from the electrical contacts and got the tractor working again.

The third breakdown came while Wagers was trying to maneuver his trailer into loading position. It caught on a mine rib near the loader. He put the tractor in forward, reverse, and then forward and reverse again. He was now almost free, and he nudged the tractor into forward one final time. It chose that moment to lurch back-

ward. Wagers' skull was crushed between the end of the machine and the coal wall.

"They were all intelligent men, they were bright," A. T. Collins, the conveyor operator, told me later as we sat in the living-room of his home in hilly Manchester County. "They could learn how to operate machinery, but they knew there was danger. The thing is, they had no choice but to take a chance on their lives."

A thin, sad-faced man who has spent all his life in rural Kentucky, Collins is just "A.T." to his friends and relatives. He was still recovering from his brush with death when I stopped to see him, and he grew somber as we talked. "One of the worst things is not being able to sleep," he told me. "I dream about everything in the world, but mostly it's about those men in the mine and how quickly it all happened."

"I got up early that morning; we used to catch a ride on a coal truck. It's pretty close to an hour's drive, and I'd get there early to get my belt going before work time. With the cold weather, I'd have a little trouble getting stuff running like I ought to."

With the conveyor belt operating smoothly that day, Collins settled down to keep an eye on things. Later on, superintendent and mine foreman Walter Hibbard waved his lantern for Collins to come down to him.

"I've got a lot of work to do down at the base," Hibbard said. Then, winking and nudging Collins, he added, "I brought Walter Bentley down here to shoot a couple of boom holes."

"Boom hole" is the term used for a recess blasted in the ceiling of a mine to make space for a coal-loading boom on the inside end of a conveyor belt. As the mine went deeper into the mountain, the main conveyor was lengthened and spurs built off to either side. A 500-foot side belt already extended to the east. The 190-foot coal wall between what were really two adjoining mines,

INVESTIGATORS ENTERING THE MINE to look for clues. They reported the improper use of explosives



LONE SURVIVOR A. T. Collins recalls how recess had to be blasted to accommodate conveyor loader

Finley No. 15 and No. 16, had been broken through so another conveyor could be built to the west. The single main belt from No. 15 could then be used to bring out all the coal.

"Hibbard told me the blasting wouldn't amount to much," Collins said. "In other words, he didn't want to scare me. But I had a feeling I'd be better off outside."

Collins' foreboding was to prove tragically accurate. Strict safety measures would have forbidden the use of the large quantities of explosives needed to blow boom holes when men were working in the mine. Still, on the morning of Dec. 30, the day shift climbed into the rubber-tired trailers and were hauled to the working areas about 6:45

(Please turn to page 201)



ANOTHER FIRST FROM POLAROID:

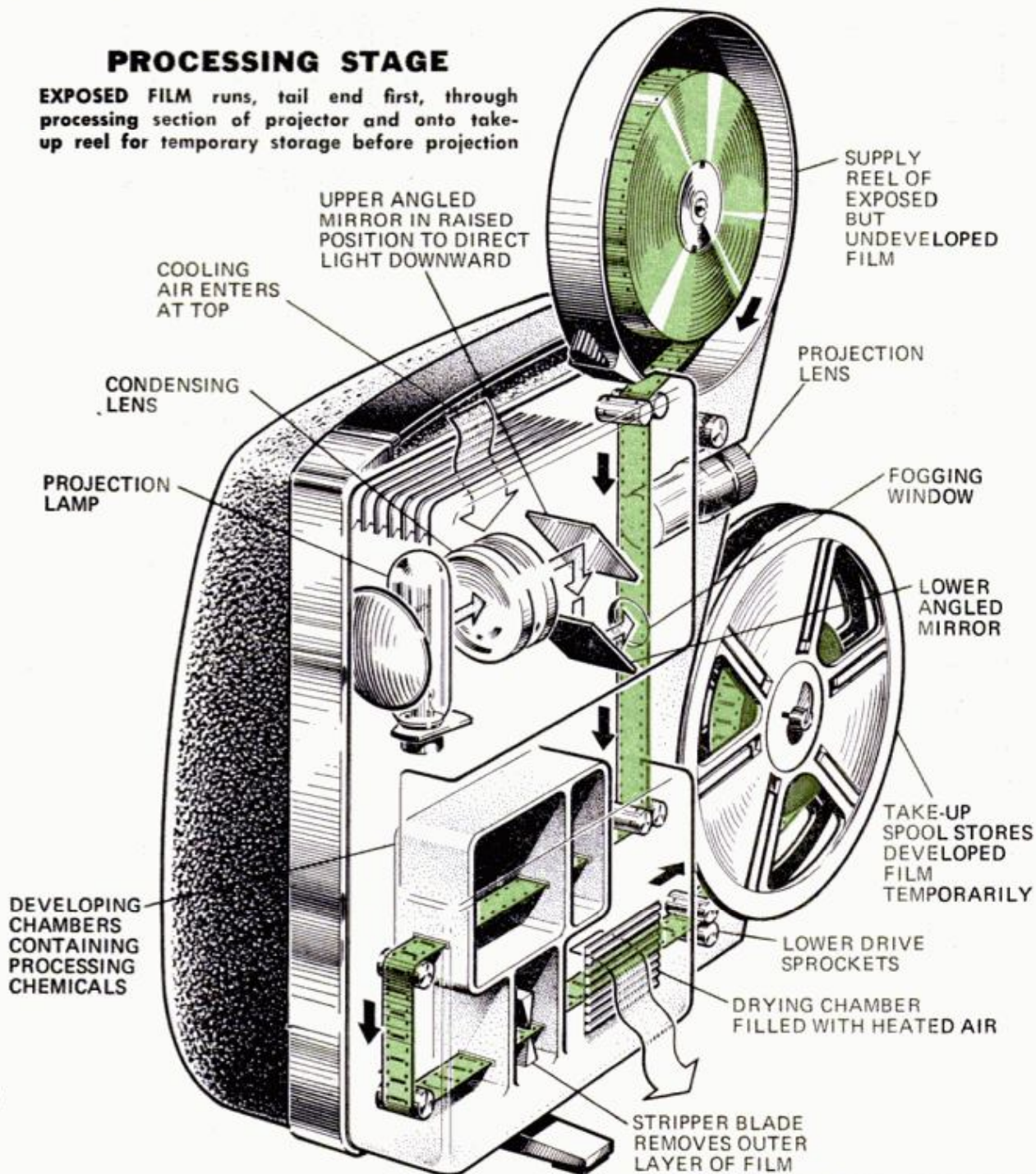
Now It's Instant Color Movies!

From taking movies to showing them is only a matter of minutes in this ingenious self-developing projector invented by the creator of the famous instant-print Polaroid camera

By SHELDON M. GALLAGER

SUPPOSE you could shoot a roll of color movie film and pull it out of the camera fully developed, just as you now pull a finished color print from a Polaroid camera. Impossible? Not according to Dr. Edwin H. Land, inventor of the instant-print process. Using similar technology, Dr. Land has come up with a new system for self-developing movies, the only difference being that the processing takes place in a special projector instead of the camera.

The device looks much like a conventional movie projector. You insert a roll of exposed film in the top, encased in a sealed cartridge. The film runs down past a window where it's deliberately "fogged" by light from the pro-



jection lamp reflected downward by a pivoted mirror. This separates the various emulsion layers into different colors. Everything in one layer is fogged out except red, everything in the next layer except blue and everything in a third layer except green. These three colors, when combined in projection, produce full-color images of the original scene, just as in color TV.

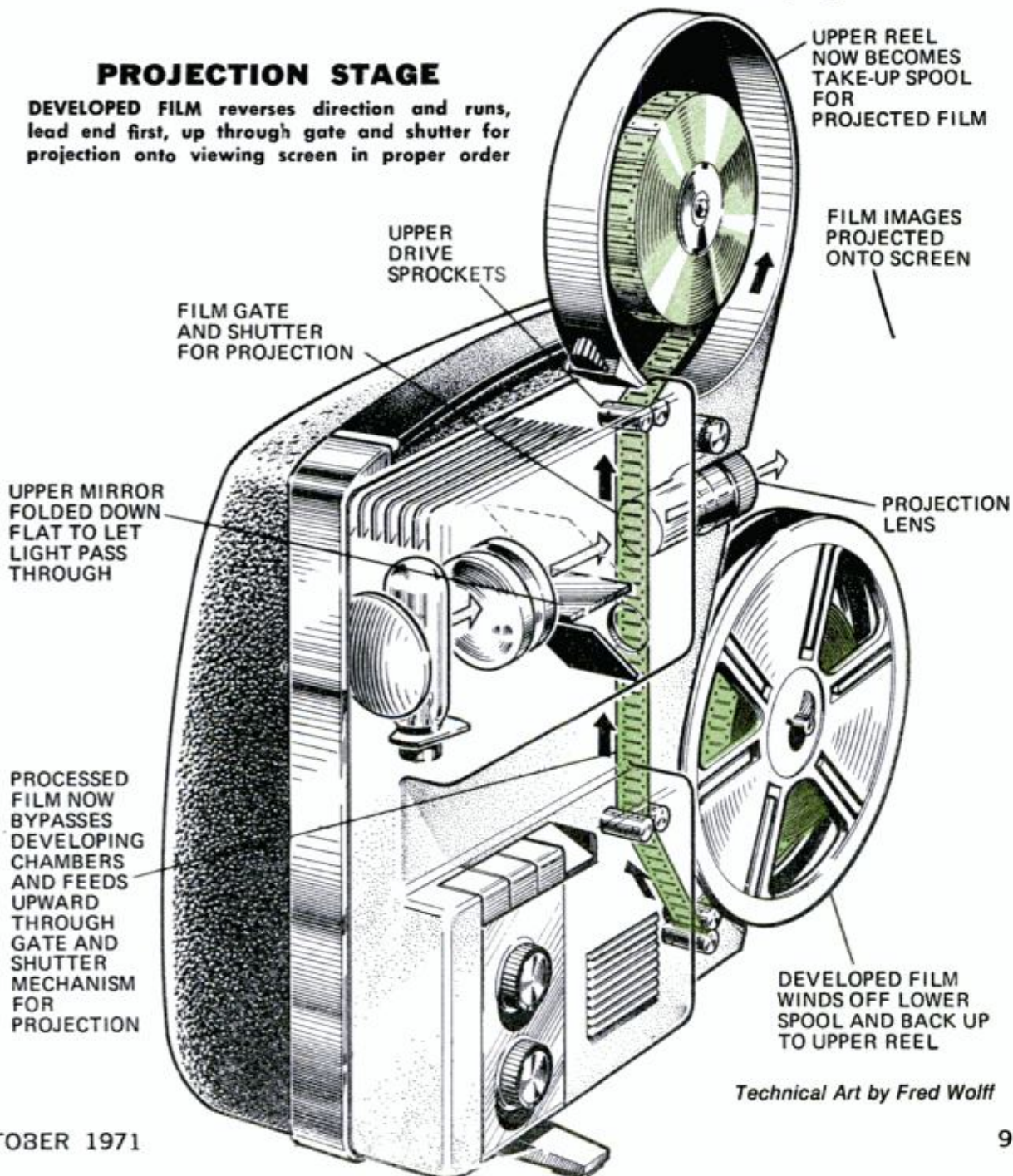
After fogging, the film passes into developing tanks, then is squeezed between stripper blades that scrape off the outer coating much like you peel the backing off a Polaroid print. Finally, the developed film feeds through a drying chamber and onto a take-up reel. A clever touch here is that the

same air drawn in to cool the projection lamp is heated in the process and used, in turn, to dry the film. To project the film, you simply press a button and it winds back up onto the reel at the top, bypassing the developing tanks. The fogging mirror flops down out of the way and the light beam shines directly through the film and lens to project the images onto the screen.

What form production models will take is not yet certain. Polaroid may market just the developing apparatus as an accessory, enabling you to show developed film on a standard home projector. Also rumored to be coming soon are instant color transparencies you can show in a slide projector. ★★★

PROJECTION STAGE

DEVELOPED FILM reverses direction and runs, lead end first, up through gate and shutter for projection onto viewing screen in proper order



Technical Art by Fred Wolff

NEWS BRIEFS



Amphibious bicycle

Retractable floats and propeller make it possible for Bob Miles, British schoolteacher, to pedal his Floatobike on land or water. His water speed is a steady four knots.



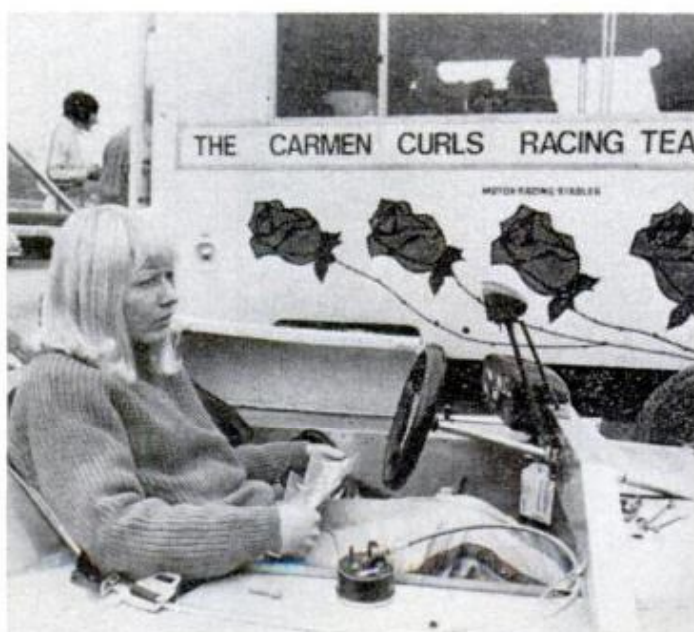
Foam home

A wood wall that runs the length of the house is one of the few straight lines in the "Soft Edge" Foam House created by West-Point Pepperell. The house was created by foaming a fabric with liquid urethane to create six dome shapes and one tunnel shape. The fabric, industrial nylon by WestPoint Pepperell, was supported by weather balloons during foaming. The exterior is at upper left; "sun dish" at left; and living room, above.

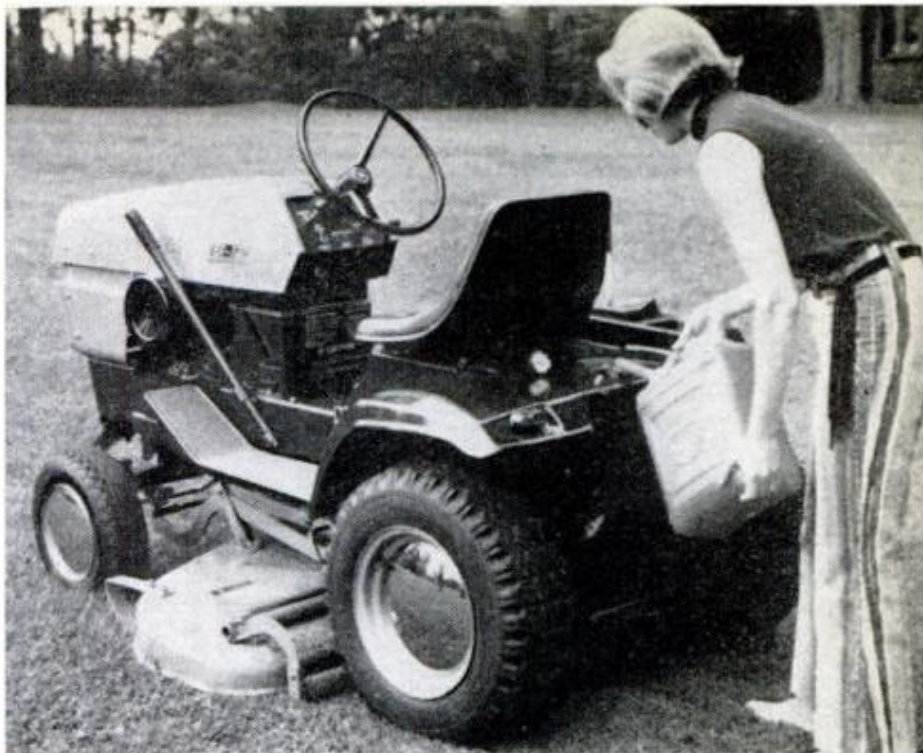
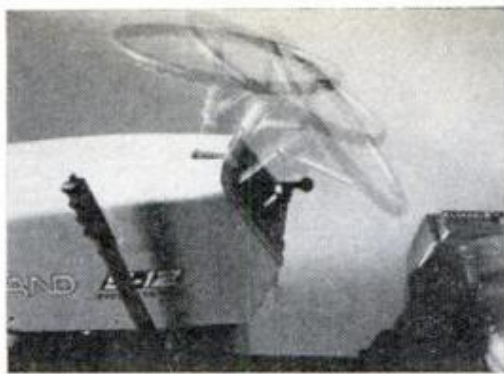


Hair curlers and F100s

Hair curlers, beauty lotions and rosebuds are part of the Formula F100 racing scene these days around such previously masculine strongholds as Brands Hatch. It's not that a new team of lady racers fuss around with such frills when they're racing (on the contrary, they're serious and doing quite well); it's just that their sponsor makes beauty supplies. The team, called the Carmen Curls, was started by Tina Lanfranchi, wife of a British driver. The seven-girl team now has two cars and two drivers, Gabriele Konig and Micki Vanderville (the blond in the photos at right). The second photo at right shows a pit crew member adjusting a steering mechanism, and at far right car 26 hits 140 mph.



POPULAR MECHANICS



Sleek styling and easy servicing mark New Holland tractors

Three models—8 hp, 12 hp and 14 hp—appear in New Holland's lineup of garden tractors this year. Among the features are "sports-car" styling, hydrostatic transmission, hinged hood and rear deck for easy servicing (photo, right) and tilting steering wheel (upper left-hand photo). Numerous accessories include rotary tiller (lower left-hand).

Articulated train

Shown in model form is a new articulated train that is scheduled to go into use on the Wuppertal, West Germany, suspended railway. Each train is made up of three cars: long ones at each end and a shorter one between them. The new units may be in service late this year.





Disney Builds the Clean,

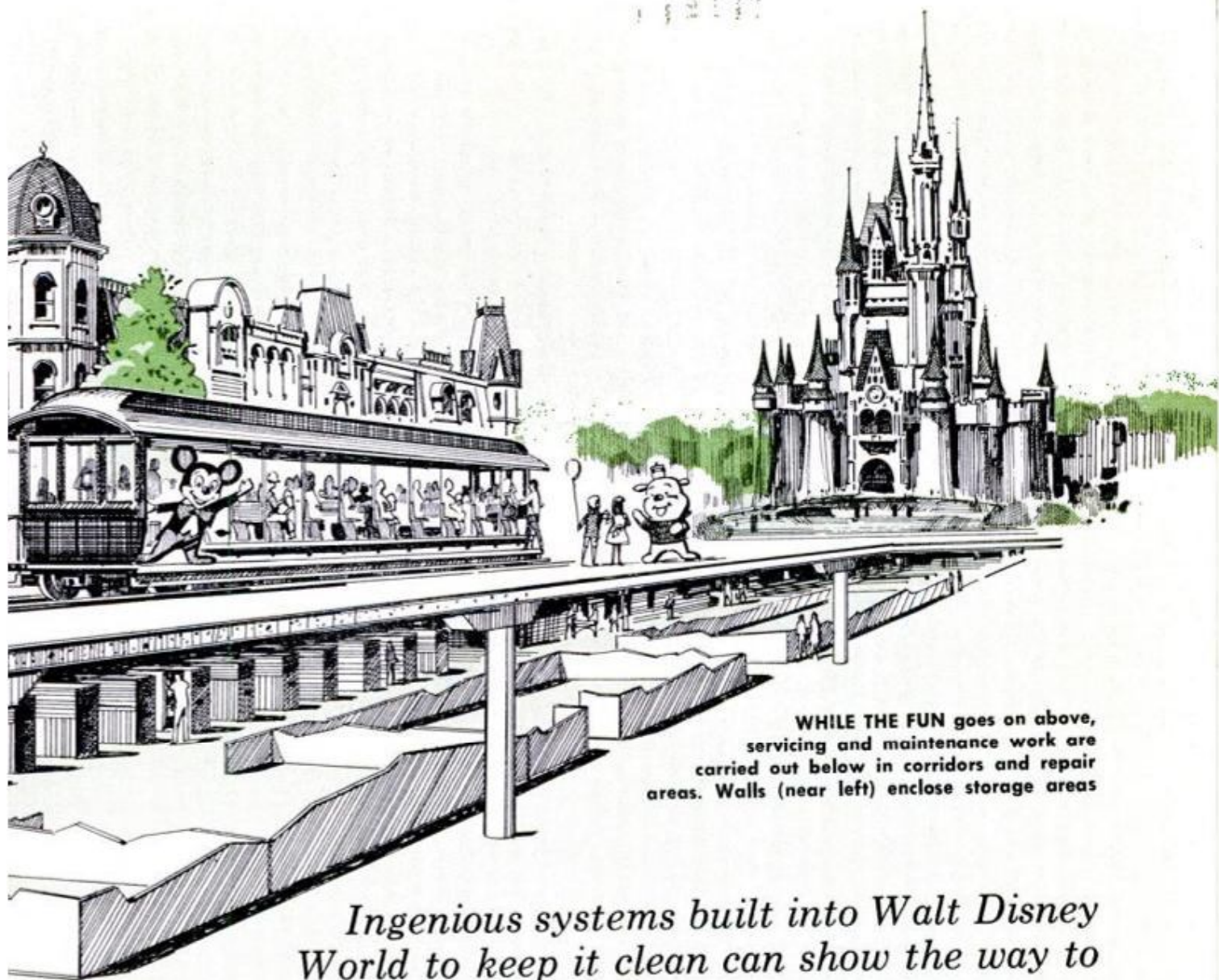
THE CURTAIN GOES UP this month on today's greatest show on Earth—Walt Disney World, a \$300-million, 43-square-mile vacationland near Orlando, Fla. At its center is a fancier, larger version of California's famed Disneyland.

But Disney World has more to offer than entertainment. It's designed to be a preview of the kind of America we can have tomorrow. Here the air and water will be pure, much of the wilderness will remain untouched, and man will be master—not victim—of the machine.

With 10 million people visiting the park each year, its example soon should have an impact on citizens in every part of America, including city planners, politicians, housewives, automakers and industrial polluters.

Here, in a "town" that will host 35,000 people, will be nuts-and-bolts proof that good design can preserve the best of nature without being more expensive. Here, as well, will be machinery, materials and systems to make life in the future pleasanter and safer. Even bigger innovations are in the offing.

To see it all, you must first park your



WHILE THE FUN goes on above, servicing and maintenance work are carried out below in corridors and repair areas. Walls (near left) enclose storage areas

Ingenious systems built into Walt Disney World to keep it clean can show the way to pollution-free cities of the future. By ELLIOTT H. McCLEARY

Green World of Tomorrow

"smog generator" in a 12,000-car lot more than a mile from the 100-acre family entertainment park. In Walt Disney World the automobile is kept on the fringes, barely tolerated.

You are taken in a tram to a loading area where you can board an electric monorail train or one of a fleet of watercraft—replicas of old-time steamers—that ply a manmade lagoon. Like virtually all the boats and nonelectric vehicles in the park, the tram is powered by clean natural gas compressed on the premises for engine fuel.

Smoothly and quietly the monorail



train—one of six built at a nearby aircraft plant and suitable for commercial commuter use—zips toward the amusement park at speeds of up to 45 mph.

On the way, it passes near the Polynesian Village Hotel and directly through the open-air lobby of the 14-story Contemporary Resort Hotel. Both were built by U.S. Steel, using a technique that may cut construction costs in buildings of the future. Lightweight modular units constructed at a nearby assembly plant were lifted by crane and fitted into place like books on shelves, ready for use when plugged into utility lines.

In its two-and-a-half-mile journey, the monorail skirts the edge of 450-acre Bay Lake and completely circles a connecting 200-acre lagoon. The sparkling blue waters of the lake and lagoon, dotted with sailboats, edged with swimmers and sunbathers, belie the past appearance of this spot.

Before Disney came, Bay Lakes' water was stained brown by the cypress swamps that fed into it; the bottom was covered by a thick deposit of organic residue. Although natural factors were responsible for its condition, it was a typical "over-enriched" lake.

"The Disney treatment of Bay Lake

could be emulated elsewhere to restore lakes to their original state," *Popular Mechanics* was told by College of Orlando biologist James M. Thomas. "It would be costly, but in a city the results would be very valuable."

Disney engineers drained the lake and removed the layer of organic debris from the lake bed with huge earthmovers. Beneath the muck was a bottom of pure-white sugar sand, part of which was shoved up on shore to form dazzling beaches all the way around.

Equally challenging was the digging of the 200-acre lagoon. With the 8-million cubic yards of dirt excavated from the lagoon, engineers raised the level of the entertainment park site 12 feet above its surroundings. This made possible one of Disney World's most significant features: tunnels called "Utilidors" (short for utility corridors) beneath the streets. Through them, electric tractors will pull food and supply-laden carts, leaving the streets above clear for people. No air pollution, no injured pedestrians.

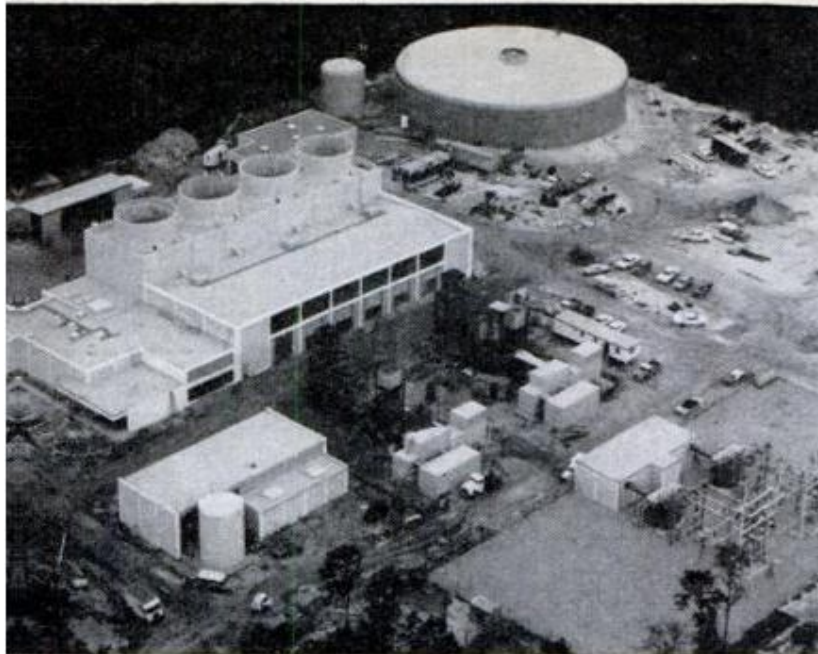
The Utilidors are the favorite attraction of visiting city engineers and planners for many reasons. Lines for electricity, communications, compressed air (for amusement rides), heating and

FANTASTIC TREEHOUSE "grows" in Adventureland with the help of a skilled crew of steelworkers



BLOCK ABOVE WORKMAN is a giant "flowerpot" for tree on surface. Valve controls the watering system





CENTRAL ENERGY PLANT provides power, airconditioning and water; uses natural gas to cut down on pollutants. Engineer at the control board monitors complex operation

cooling and drinking water are hung from the tunnel ceilings and walls, always accessible for inspection or repair. When a break or leak occurs a repair vehicle hurries to the spot and workmen standing on it quickly correct the trouble. Digging up streets to get at utility lines will be a thing of the past.

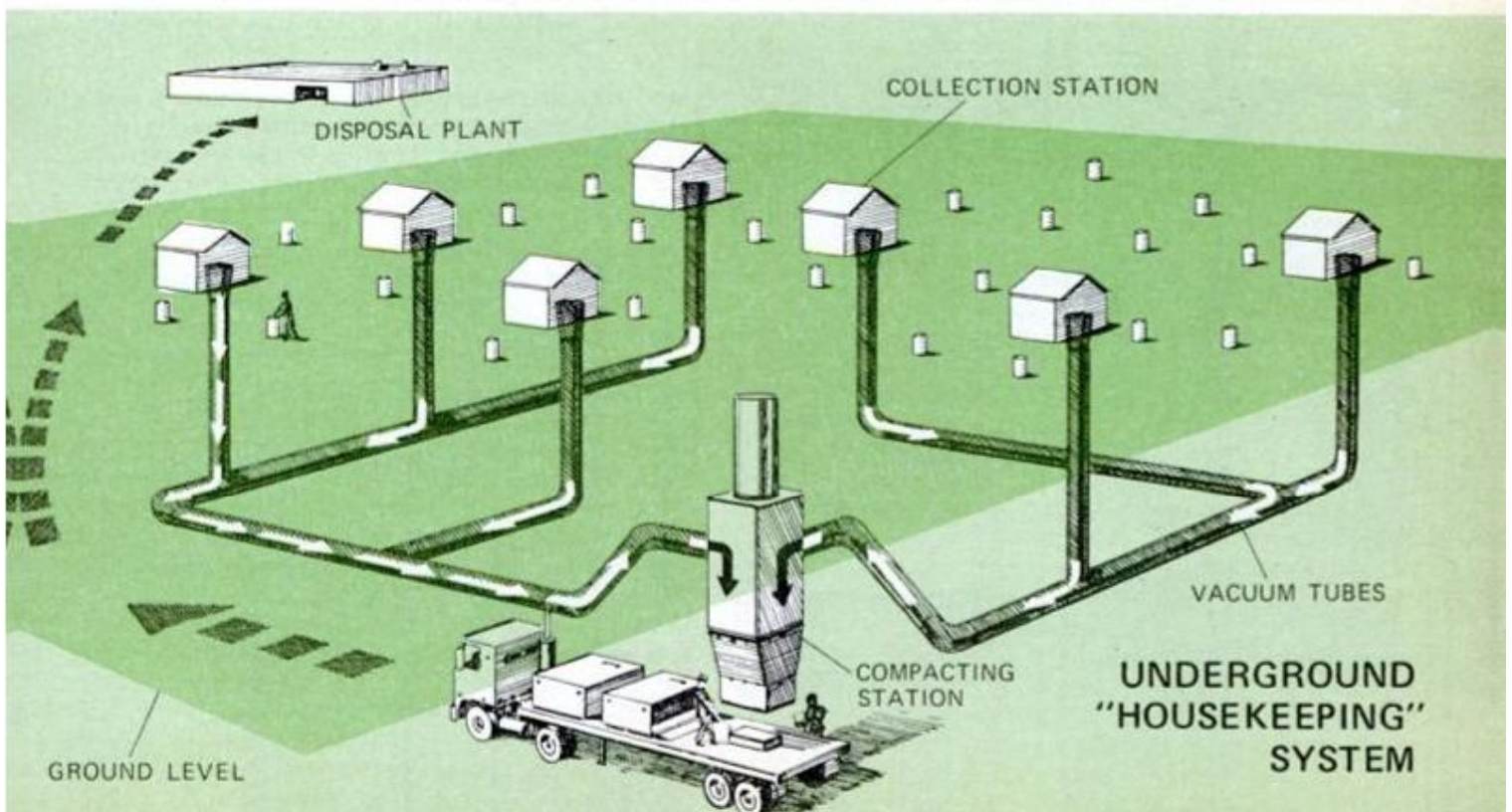
No garbage trucks will hamper tunnel traffic. Instead, wet garbage will be ground up and carried away by the sewage system.

That still leaves the trash left by up to 50,000 people a day. It's a huge heap

of junk, at one and a half pounds per person, even though Disney World will prevent can and bottle litter by selling drinks in paper cups.

Solution: a system of underground pneumatic tubes that suck discarded paper, plastic, boxes, even objects as heavy as a storage battery, from 18 dump stations scattered around the amusement park. Compacted at a central collection point, the condensed trash is hauled by covered truck to the main Disney World incinerator one and a half miles away. The system was brought to America from Sweden by a

COLLECTED AT DUMP STATIONS, trash will be drawn through tubes to a collection station for compaction



U.S. firm and will probably see wide application throughout this country.

Other environment-protection features of Disney World are embodied in the remarkable \$19-million power system, which offers living proof that ideal pollution control is truly practical. "Considering all of our special needs," says public works chief Harvey Jones, "such as compressed air for rides and a standby electric system, it's no more expensive than a conventional system."

Built from scratch to handle all requirements of Walt Disney World, the power system imposes no burden on surrounding Orange and Osceola counties. Two 8000-hp jet aircraft engines, fueled by clean-burning natural gas, push a stream of 1500° air through turbines geared to electric generators.

Instead of discharging the hot turbine-cooling water into a nearby stream and disturbing the natural balance, they channel it into boilers that raise its temperature to 400°. The hot water, like the flame in a gas-powered refrigerator, supplies energy for a lithium-bromide process that chills water to air-condition all the amusement park buildings and the hotels. It's also piped to all the hot-water faucets in the park, and in chilly weather heats the buildings instead of helping to cool them.

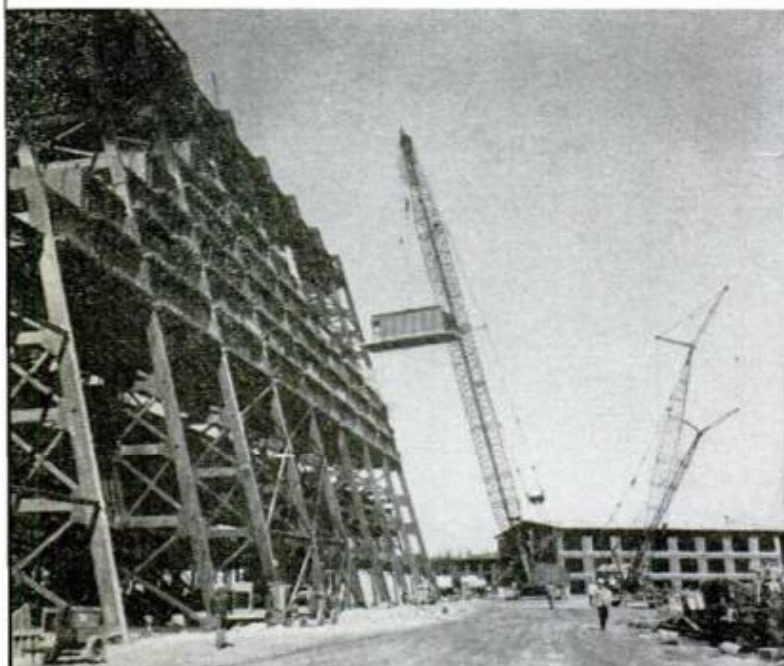
Normally, over half of Disney World's electric bill would be for aircondition-

ing. So an ingenious system that safeguards the environment results in a cash saving as well.

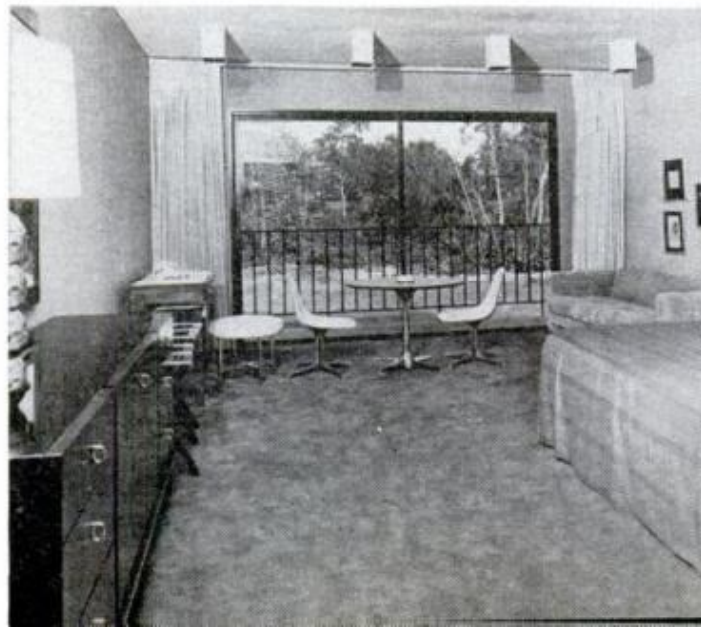
A \$2.5-million activated sludge sewage plant cleans 3.3 million gallons of water per day in three stages, producing an effluent that nearly meets public health drinking-water standards. The sludge that's removed is used as a soil conditioner and fertilizer.

Some of the effluent is used to reduce air pollution: It's sprayed on fumes from the incinerator to keep them down and to capture fly ash. (In turn, the suspended fly ash is recycled to the sewage plant where it is used to clarify effluent.)

The remaining effluent still contains enough nutrients to proliferate the growth of algae and weeds in lakes and streams. It's a process happening all over America, contributing to the "death" of bodies of water, driving out good sport fish. University of Florida agricultural experts have suggested a solution that towns and cities may want to copy for profit as well as for pollution control. Disney World will spray-irrigate a 600-acre experimental farm where the chief crop will probably be fast-growing hardwood eucalyptus trees. The method, proved in northern as well as southern states, speeds up growth of a profitable crop while keeping undesired nutrients out of bodies



MODULAR ROOM UNITS were used in building hotels at Disney World. Only furniture and carpeting were added after unit was slipped into place at construction site. Each room accommodates family of five



of water. (Trees can absorb and evaporate large amounts of water; contamination is not a threat, as it might be with food crops.)

The success of this and all other pollution-control methods in Walt Disney World will be gauged by what happens to a 7500-acre conservation area set aside on the western and southern edges of the huge 43-square-mile property. Reedy Creek Swamp—5000 acres of cypress, palm trees and palmetto inhabited by deer, cougar, bear, birds and alligators—accounts for most of the area. Tourists will be kept out, though serious students of nature will be permitted to take electric boat rides for a mile and half down a creek that borders an edge of the swamp.

If the millions of Disney World visitors are kept within bounds and the air and water remain pure, then the conservation area should prosper. But carelessness or accidents could tip the balance of nature adversely.

The rest of the huge property has been altered drastically. Beginning in 1965, the soggy part of the land was drained by the digging of some 40 miles of canals. Instead of leaving it at that, the developers installed 19 water-control structures of French-Algerian design to better guide the movement of flood waters through the area, and to raise and lower water levels during the

year to simulate Florida's typical drought-flood cycle.

Dikes were built around the property. On the east and south, these hold flood waters that have drained rapidly off the acres of building sites and paved areas to the north, for gradual release onto neighboring land. On the north, they protect the property against water from a mostly rural 70-square-mile area.

Normally, the water—tested daily for purity—is allowed to pass through Walt Disney World. If it should ever arrive polluted, however, the control gates would be closed and the offending liquid routed around the property—until Disney investigators could identify the pollution source and eliminate it.

Visitors wonder at the size of Walt Disney World—27,400 acres compared with the 340 acres of the original Disneyland in California. The entertainment park proper is only 30 acres larger than its 70-acre counterpart in California. The "Vacation Kingdom" in Walt Disney World—including golf courses, Bay Lake and lagoon, wooded camping

(Please turn to page 203)

MONORAIL TRAINS pass through 14-story Contemporary Resort Hotel as they travel a three-mile circuit



PM OWNERS REPORT MAZDA ROTARY-ENGINEED COUPE

A Nationwide Survey Based on
390,000 Owner-Driven Miles

IT'S STILL TOO EARLY to judge the Mazda's success in this country, and success will come only if Americans accept the Wankel rotary engine. Whether U.S. car buyers are that adventuresome remains to be seen. Of course, when the domestic automakers actually start building rotaries, and that seems to be a likely eventuality, they *will* be accepted.

Oddly, the Mazda owners we surveyed aren't in jobs that you'd consider adventuresome. The largest group (36.5 percent) are blue-collar workers—truckers, carpenters, bricklayers. Next come technicians (23.8 percent), followed by career women (yes, *women*) at 12.8 percent. Professional men and white-collar workers combine to make up only 8.0 percent. Most owners, too, are young—under 30—and almost all of them live in Oregon and Washington, the first two states where Mazdas were sold.

Why do people buy Mazdas—what attracts them initially?

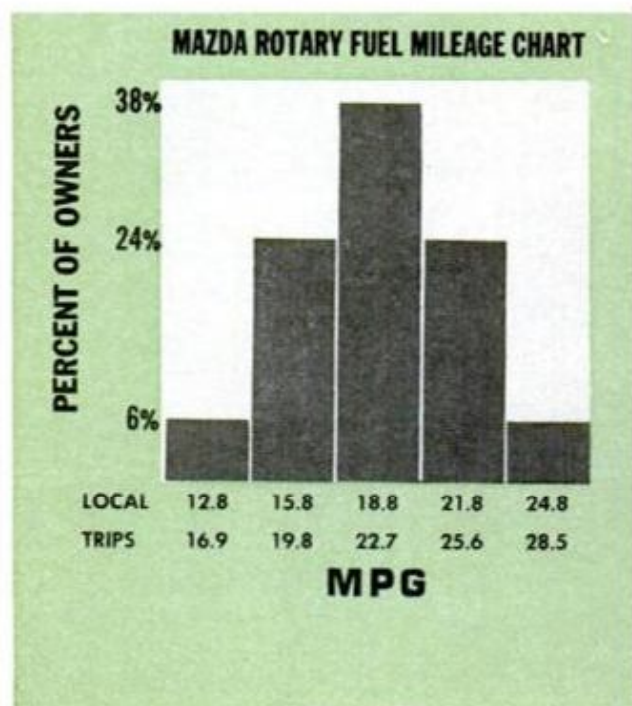
"I truly think the rotary is the engine of the future," observed a Portland truck driver, and he was seconded by a goodly number of other owners. A teacher from Woodburn, Ore., admitted, "For the novelty of owning a rotary engine."

And a Seattlite: "Quiet, no vibrations, and the car is a little overpowered." (Now there's a switch!) A sawmill operator from Bend, Ore., remarked, "I was wondering how the rotary engine worked and I came home with one."

What are Mazda owners' specific likes? Several mentioned the rotary's reduced exhaust emissions, citing that as one reason for buying. But many more told about the rotary's silence, its responsiveness and lively performance. A student in Butte, Mont., noted, "It cruises well and is quiet—also has

Mazda's Not a Lamp—But It

By MICHAEL LAMM, West Coast Editor Photos by the Author



enough power for passing at high speeds.”

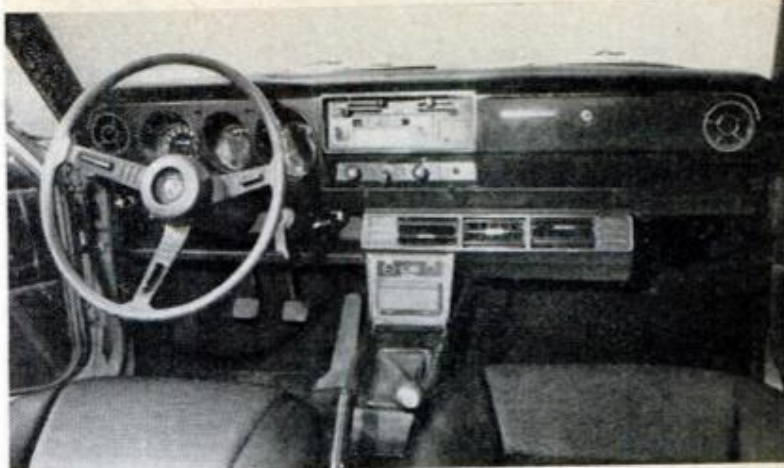
This is true because the tighter you wind the rotary, the stronger it pulls. And with no reciprocating parts, the rotary needs a governor to keep it from revving too high—because without one the rpm would just keep climbing until the engine flew apart.

Other specific likes included: “This car is the most fun to drive of any I have ever owned. On the open road, curvy mountains, snow or ice, you’d have to be pretty careless to get into trouble with it.”—La Grande, Ore., radiologist.

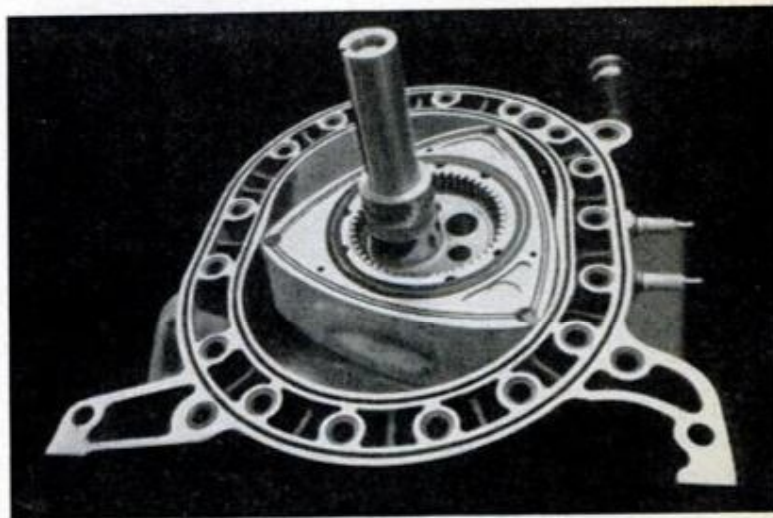
“My Mazda is a great-handling car,” says an Oregon millworker, “especially on corners. Generally among all the imports I test drove, I found the Mazda superior in quality, design, and performance.”

What *don't* Mazda owners like about their cars? “Fumes inside the afterburner make a popping noise, like a gun

TWIN-ROTOR WANKEL, with three moving parts and half weight of four-cylinder engine, delivers 120 bhp



THE RX-2 MODEL has idiot lights instead of gauges, but, overall, dash is well laid out and very sporty



Really Lights Up Most Owners





RX-2 COUPE spans 97-in. wheelbase, R-100 uses 89-in. Radial tires and sporty wheels both are standard



GAS TANK is mounted high behind rear seat, spare tire in its own well, so trunk is square, uncluttered

CLEAN LINES attracted number of buyers, but many say they'd appreciate a Z-240-like rotary sportster



being fired, when you slow down."—Seattle nurse. "Gas mileage should be better."—Othello, Wash., trucker. "I wonder about parts and resale value, but it's too early to tell."—Oregon herbicide applicator. It's also too early to tell whether the rotary engine will hold up—no one surveyed had more than about 8000 miles on his car.

Other complaints centered around the smallness of the rear seat, of the trunk (which is actually fairly large for

Author Tests the Mazda RX-2 Coupe

I was privileged to drive the Mazda R-100 rotary coupe a couple of years ago when it was first brought into Canada (*Canada Joins the Rotary Club*, page 208, Dec. '69 PM), and that car's performance and quality left me favorably impressed. Owners of this model were surveyed for our Owners Report.

Then last month I drove one of the first Mazda RX-2 coupes to be imported into the United States, and man! What a car this is. It's the nearest thing you'll be able to get to a Porsche for \$2800.

The RX-2's handling is what makes it really outstanding. It corners like no other economy car I've ever driven (including Vega), and it's one-up on many sports jobs.

The RX-2's Wankel engine is strong, smooth, fairly quiet and fairly economical. And this Mazda, again, was very well put together; its ride is comfortable, its standard equipment amazingly complete.

The rotary powerplant sounds and feels much like a two-stroke piston engine—smooth on acceleration and stronger the higher the rpm, but rather poppety on deceleration. I clocked acceleration on both cars and here are my times in seconds:

	R-100	RX-2
0-30 mph	4.6	4.0
0-40 mph	8.3	6.7
0-50 mph	10.1	8.3
0-60 mph	12.2	10.8

Summary of Mazda R-100 Owners Reports*

Total miles driven390,437

Average miles per gallon
 Local driving18.8
 Long trips22.7

Why did you buy a Mazda?
 Rotary engine39.7%
 Economy23.8
 Styling20.6
 Handling17.5

Specific likes:
 Handling45.2%
 Power43.6
 Comfort27.4
 Performance25.8
 Economy of operation24.2
 Silence of operation21.0

Specific dislikes:
 Poor gas mileage32.8%
 No rear legroom16.4
 Tires (various maladies)11.5
 Rattles8.2
 Car too small8.2

What changes would you like?
 Different size21.4%
 More legroom21.4
 Sportier styling19.6
 More power12.5
 Better gas mileage7.1
 Bigger trunk7.1

Had any mechanical troubles?
 No69.8%
 Yes30.2

What kind of trouble?
 Wheel alignment21.0%
 Electrical system15.6
 Smog-control plumbing10.5
 Carburetor10.5
 Oil leaks10.5
 Transmission10.5

Did you repair it yourself?
 No89.5%
 Yes10.5

Dealer repairs satisfactory?
 Yes76.5%
 No23.5

Is this your only car?
 Yes61.9%
 No38.1

Other cars owned:
 Chevrolet25.0%
 Volkswagen16.7
 Buick16.7
 Oldsmobile12.5
 Ford12.5

What about the Wankel engine?
 Needs more power32.7%
 Quiet23.6
 Smooth power16.4
 Excellent10.9
 Low maintenance10.9

Age distribution of owners:
 15-29 years58.7%
 30-49 years33.3
 50-plus8.0

Would you buy another Mazda?
 Yes85.7%
 No14.3

*Percentages might not equal 100% due to rounding and/or insufficient data.

so small a car), and the fact that oil consumption seems to be 1 to 1½ quarts per 1000 miles.

Mazda dealers are apparently more eager to serve than most other dealers, probably because they know they have an uphill struggle toward gaining acceptance of the car. Only a few owners complained that their dealer's mechanics didn't seem to know exactly what they were doing or that they got the runaround. More than a few mentioned that they had to wait a long time for parts.

The Mazda's workmanship got high marks, and owners agree that it's well engineered and carefully put together. Also, they appreciate the generous stan-

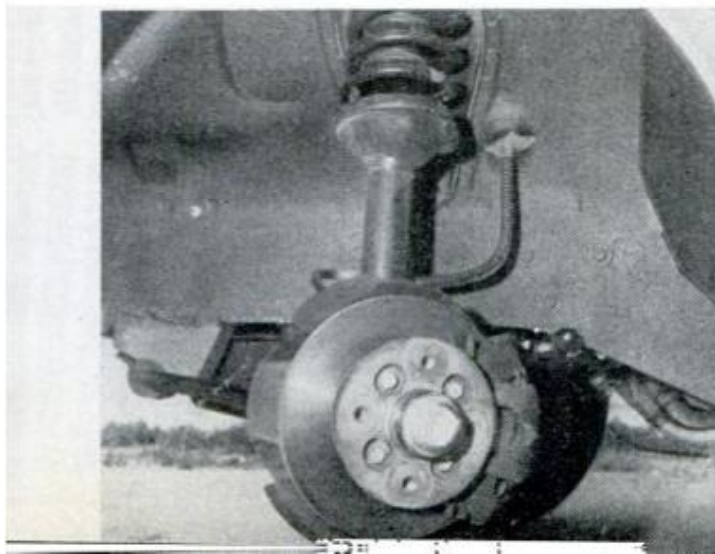
dard equipment. Says a Washington restaurant manager, "The extra niceties came as a pleasant surprise—radial tires, reclining bucket seats, the little can of touch-up paint, all-synchro gearbox, carpets, etc."

If the Wankel is the engine of the future, Mazda makes a good ambassador for it. Owners are by and large more than pleased. How the rotary holds up over the long haul remains to be seen, and whether the afterburner will negate itself by using too much oxygen is another unknown factor at the moment.

But for now it looks as if Mazda has done what many carmakers will do in coming years. ★ ★ ★

McPHERSON STRUT front suspension helps RX-2 to hold well in corners; disc brakes get power assist

LUXURIOUS, COMFORTABLE front buckets have infinitely variable recliner, but rear legroom is tight



NEWS BRIEFS



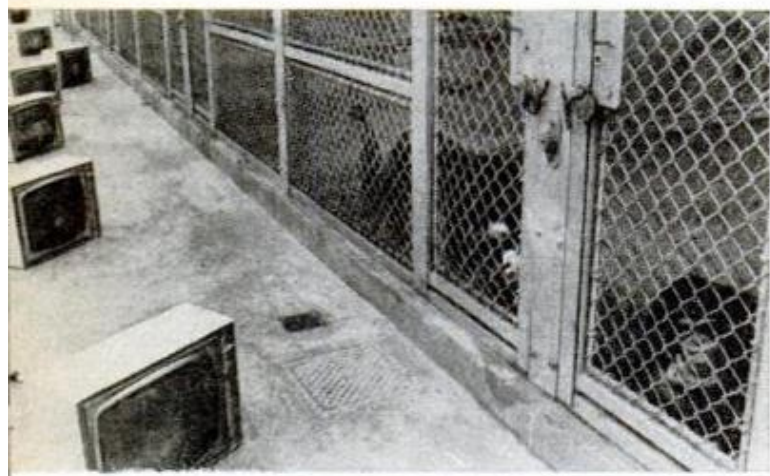
'Balcony' on an intersection

An intersection in Giessen, Germany, became so congested with traffic and pedestrians that town planners built a "balcony" over the entire square to relieve the situation. Now pedestrians walk in safety above the traffic which crisscrosses below.



80,000 pennies saved . . .

Pennies and plastic are materials used for Philadelphia's newest tourist attraction, a 10-foot bust of Benjamin Franklin. Nearly 80,000 pennies embedded in Selectron polyester resin by PPG Industries give the bust an unusual look. Photo was taken at dedication.



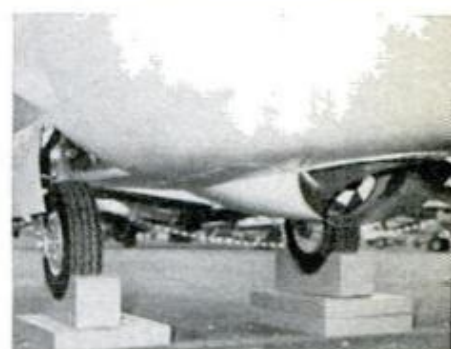
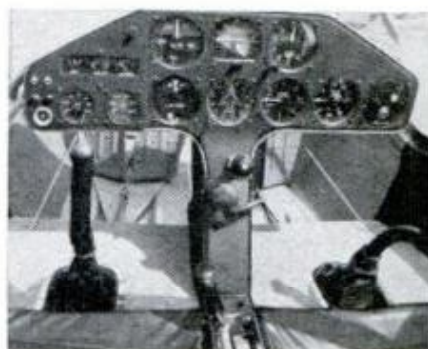
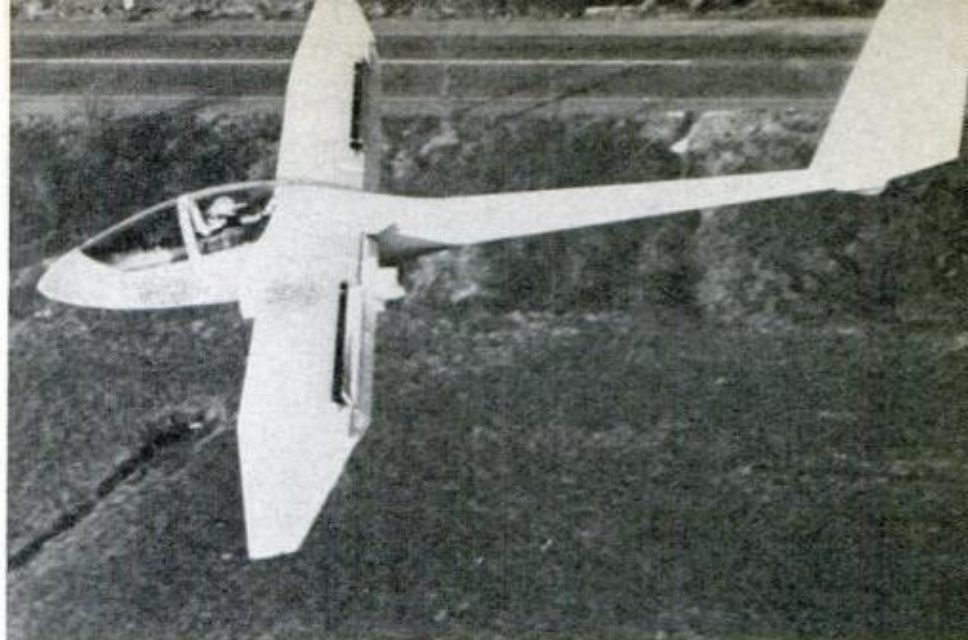
They're TV watchers, too!

Apes get just as involved in television as human watchers, report researchers at the Yerkes Primate Research Center at Emory University in Georgia. Dr. Geoffrey Bourne, director, installed 15 TV sets in the primate quarters, and the animals immediately seemed more relaxed. Chimps quickly showed that they favor Westerns—the more action, the better. However, gorillas and orangutans shied away from violence and displayed a preference for soap operas. Some animals will sit spellbound through a two-hour movie, others constantly change channels (lower right).



'Poor man's U-2'

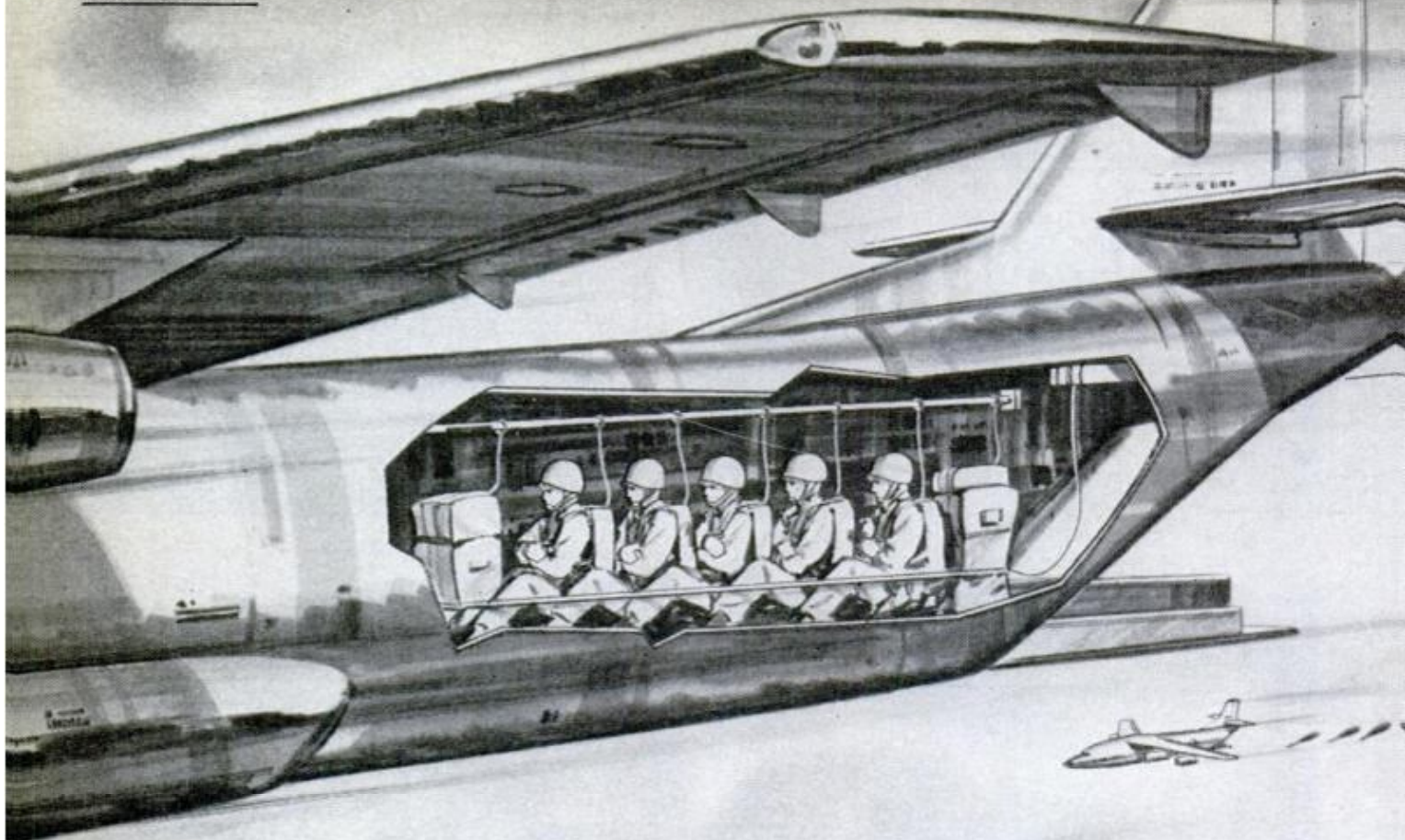
Outfitted with a 45-pound-thrust jet engine, the Calif A21J sailplane can take off without a tug launching, fly in search of thermals and finally return under power to its home field. The craft carries pilot and passenger side-by-side in its cockpit. Virtually all of the sailplane is constructed of metal; only the cockpit area is of laminated plastic. Wingspan is 65½ feet. Below are two views of cockpit and (at far right) jet exhaust and retractable wheels. Maker of the A21J is the Italian firm, Caproni Vizzola.



High light of the year

Policemen and emergency crews can have lots of light over a wide area with the Vu-Control. Carried on a cartop, the 200-pound unit raises floodlights seven feet above the rooftop at the touch of a dashboard switch. The elevating mechanism is hydraulic; the lights work on the car's 12-volt system. Maker is Weaver Div., Dura Corp., Springfield, Ill.

JUST PATENTED

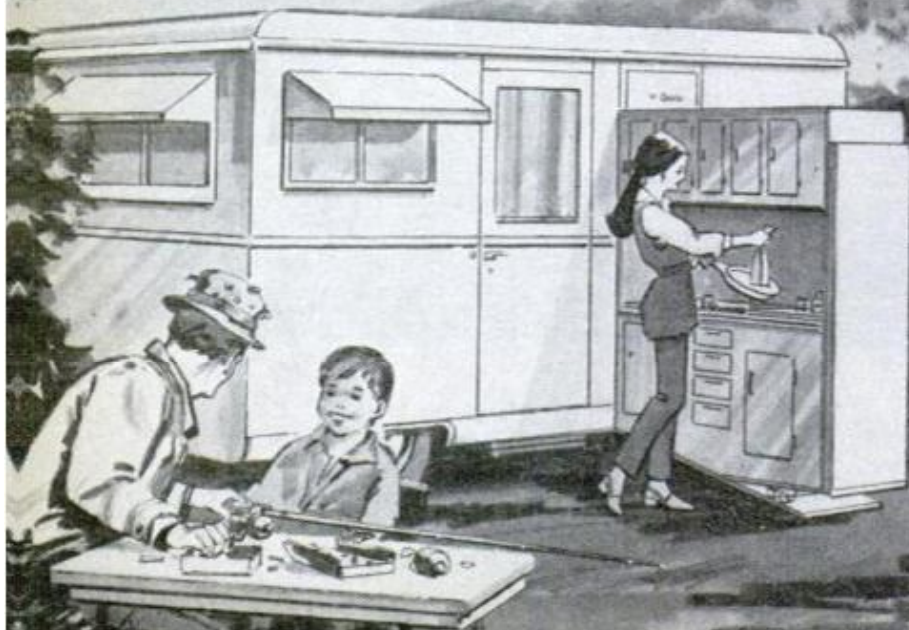


Pinpoint Parachuting: They Hit

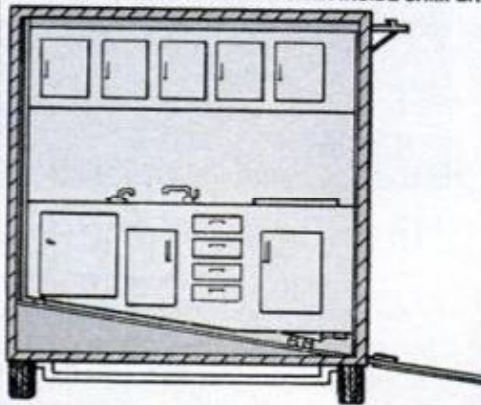
Roll-Out Kitchen for Roadside Camper Cooking

Roll out this novel camper kitchen and you're all set to enjoy outdoor cooking at roadside stops. The idea: You don't have to stay cooped up in cramped quarters inside when the weather's nice outside. Intended

for house trailers and camper vans, the self-contained kitchen unit slides down a sloping track to ground level. Invented by Lester L. Low of Talent, Ore., it also helps to create an enclosed area for privacy.



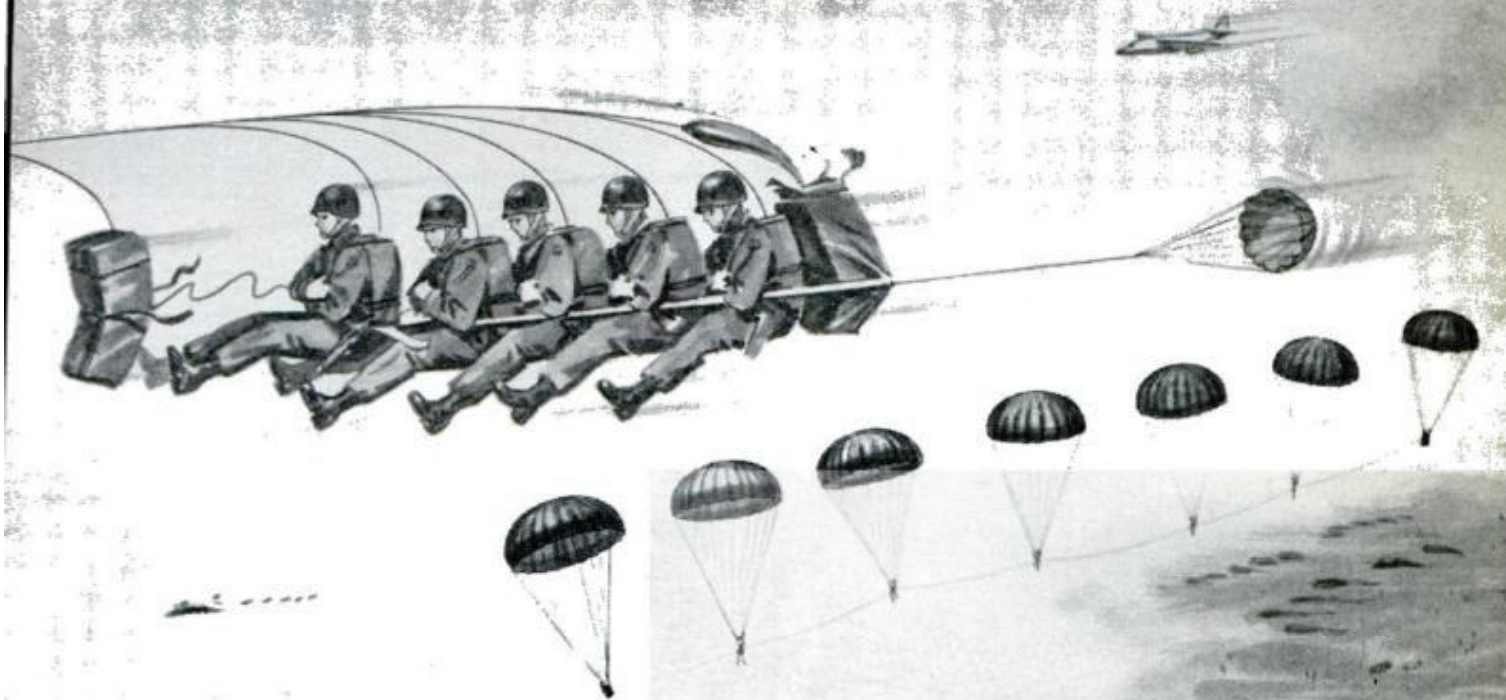
CROSS SECTION SHOWING KITCHEN INSIDE CAMPER



Illustrations by Roy Grinnell

Precise military airdrops are a problem because paratroopers jumping one at a time tend to become strung out over a large area. Often they land in widely separated locations and can't join up into a fighting force. The system shown here, under study by Lockheed, enables an entire paratroop

team to jump simultaneously. The men are harnessed together in a row with their chute-release cords attached to an overhead rail. A drogue chute pulls the men free of the plane, tripping their chute releases. The paratroopers thus land together in a small area ready for instant action.



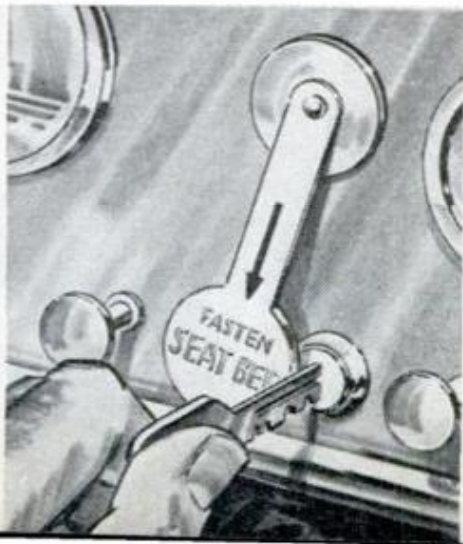
The Silk...and Ground...Together

Seat-Belt Signal

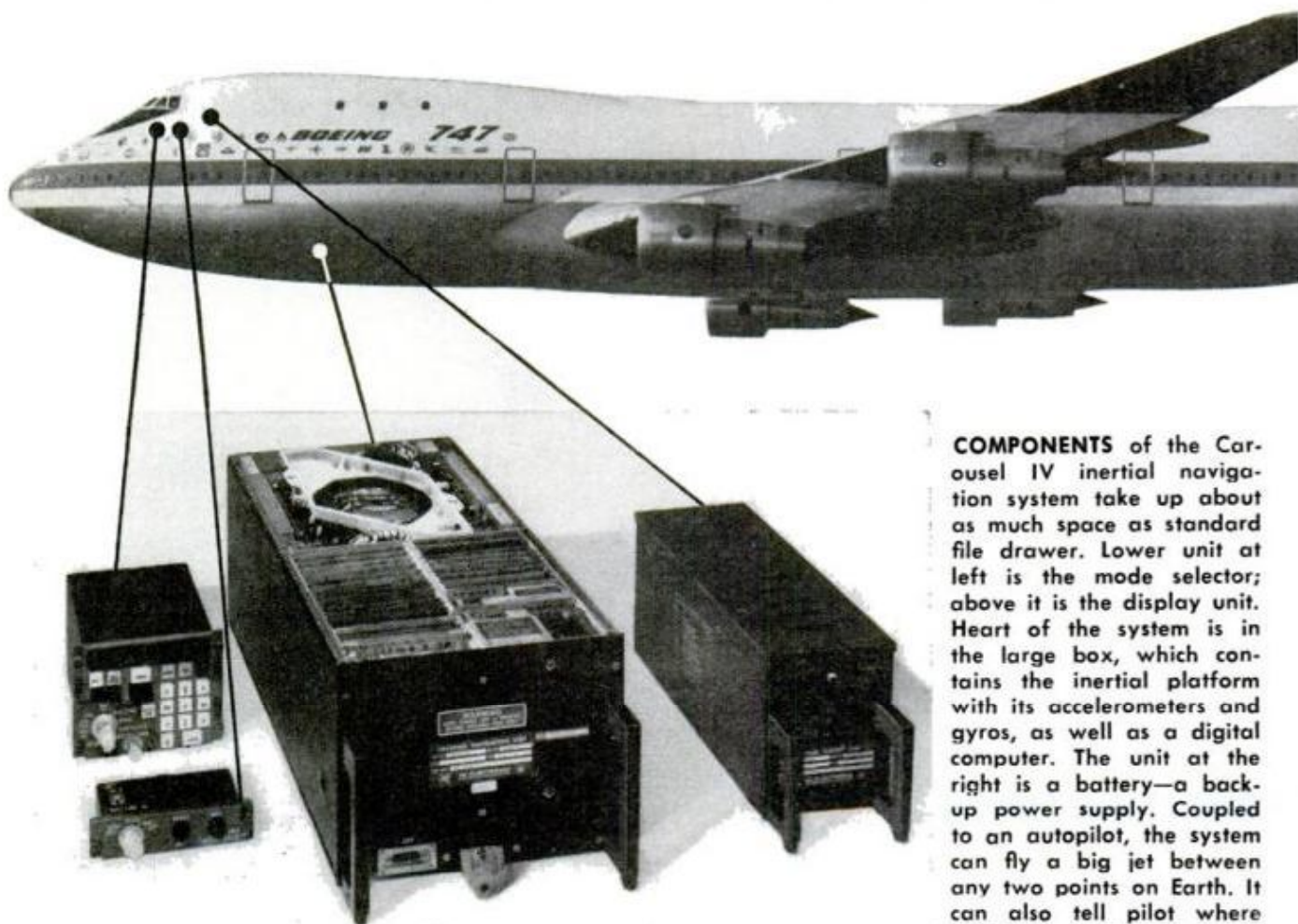
You can't start your car without first pushing aside this pivoted ignition-lock cover, warning you to fasten your seat belt. The simple reminder is designed to be cheaper and easier to install than more complicated devices. You just paste the self-adhering pivot plate on the dashboard. Inventor is Alvin L. Shook of Salem, Ill.

Instant Fire Escape

It looks like a drain pipe, but actually it's a collapsible ladder—a new idea in fire escapes to eliminate the cost and unsightly appearance of conventional escape stairs. When stored, it folds flat against the building. A crank at each window location unlocks the outer leg, which swings down along with a series of cross rungs to form a ladder to the ground. The device was developed by Minimax Ltd. in Feltham, England.



The Brain That Tells a



COMPONENTS of the Carousel IV inertial navigation system take up about as much space as standard file drawer. Lower unit at left is the mode selector; above it is the display unit. Heart of the system is in the large box, which contains the inertial platform with its accelerometers and gyros, as well as a digital computer. The unit at the right is a battery—a backup power supply. Coupled to an autopilot, the system can fly a big jet between any two points on Earth. It can also tell pilot where he is at any given moment

MUCH HAS BEEN SAID about the size of the Boeing 747—that it occupies nearly the space of a football field, that its engine nacelles are of greater diameter than a B-17's fuselage, that when fully loaded it weighs more than 140 Cadillacs.

But one of the giant's most intriguing features is an electronic unit that occupies a cubic foot and weighs slightly more than an electric typewriter. It is the Carousel IV, the inertial navigation system (INS) that tells a 747 pilot where he is and how to get to where he wishes to go. The INS provides this and much more navigational data instantly and with far more accuracy than any gear previously used by airlines. "Absolutely fantastic!" is a typical reaction when a veteran pilot first sees it work.

A brainchild of General Motors' Delco Electronics Div. at Milwaukee, the

Carousel IV is a by-product of 20 years' work with inertial guidance technology. Navigators similar in concept were used to guide the Thor and Titan missiles, and the command and lunar modules on the Apollo moon missions.

In the early days, transocean flying was accomplished by dead reckoning and celestial navigation. A pilot held a compass course which had been adjusted for variation, deviation and whatever wind information was available. En route, his navigator pinpointed actual position with sun or star shots, provided clouds did not obscure the sky. Drift was measured by dropping a smoke marker or flare onto the water and lining up the receding target with the grid lines of a drift sight. The crew which found itself "on solid instruments," a common situation over the North Atlantic in midwinter, could only

747

Where to Go!



By LEN MORGAN

The electronic marvel that puts the Apollo lunar modules on target also provides pinpoint navigation for the jumbo jets. Here, an airlines pilot tells how this amazing system works

maintain flight plan headings and hope for a break in the clouds prior to land-fall.

Radio took much guesswork out of it, at least for an aircraft within 300 miles of land. The fixed loop antenna enabled a pilot to fly a selected track to or from a transmitter; later, the rotating loop enabled his navigator to zero-in on two or more stations, plot them and come up with a reasonably accurate fix. Coastal direction-finding stations picked up a plane's signals and radioed their fix to its pilot. Then came the radio range which radiated a beam seaward so that inbound airmen could ride home on it.

Just before World War II the automatic direction finder (ADF) came into use. This godsend's needle automatically pointed to any station tuned in. Twin needles provided simultaneous bearings from two stations and seemed, at the time, everything the overwater crew could desire.

All of these aids operated at low frequency, and this was their drawback. Weather and other factors rendered their information unreliable when it was most needed. Communications with direction-finding stations and range beams were drowned out by static; ADF needles were attracted by thunderstorms as well as shore stations; at dawn, and again at sunset, low-frequency transmissions would skip over

an aircraft 100 miles at sea but would be clearly received by pilots 5000 miles away. Early radio was an aid rather than a solution.

Radar, radio altimetry, Loran (Long Range Navigation) and very high frequency radio (VHF) came out of the Second World War and were put to airline use—bringing a bit closer the day of precision overwater navigation.

The rapid expansion of transatlantic airline service in the late 1940s made precision a necessity. While half a dozen aircraft could zigzag between New York and London without endangering each other, this would not be acceptable for 30 flights, much less 60. The visual omni range (VOR) and radar afforded highly accurate close-in navigation and



VETERAN PILOT Len Morgan is qualified to fly 747s. Photo shows him during his final checkride
OCTOBER 1971

traffic separation but, while immune to most interference, suffered from a lack of range. VHF and UHF signals—like those from a TV station—follow a “line of sight,” not the Earth’s curvature.

Even when it flies at the highest legal altitude, an airliner operating between San Francisco and Honolulu is beyond the range of VHF signals for 80 percent of its schedule.

Today, most international air carrier flights navigate with Doppler equipment. The Doppler relies on four continuous radar signals between aircraft and water, providing ground speed and drift readings. This equipment will lead a flight across 3000 miles of water with great accuracy. Two entirely separate Dopplers are minimum equipment—one unit is checked against the other en route.

While a tremendous advance in the art when introduced about 10 years ago, Doppler is not troublefree. A glassy ocean does not properly reflect radar waves, causing one or both sensors to kick off. The pilot then must rely on Loran—a low-frequency device, which at times suffers from weaknesses of such devices. This is why 120-mile spacing is required on busy international routes.

The idea of inertial navigation is not new but it took the space program to

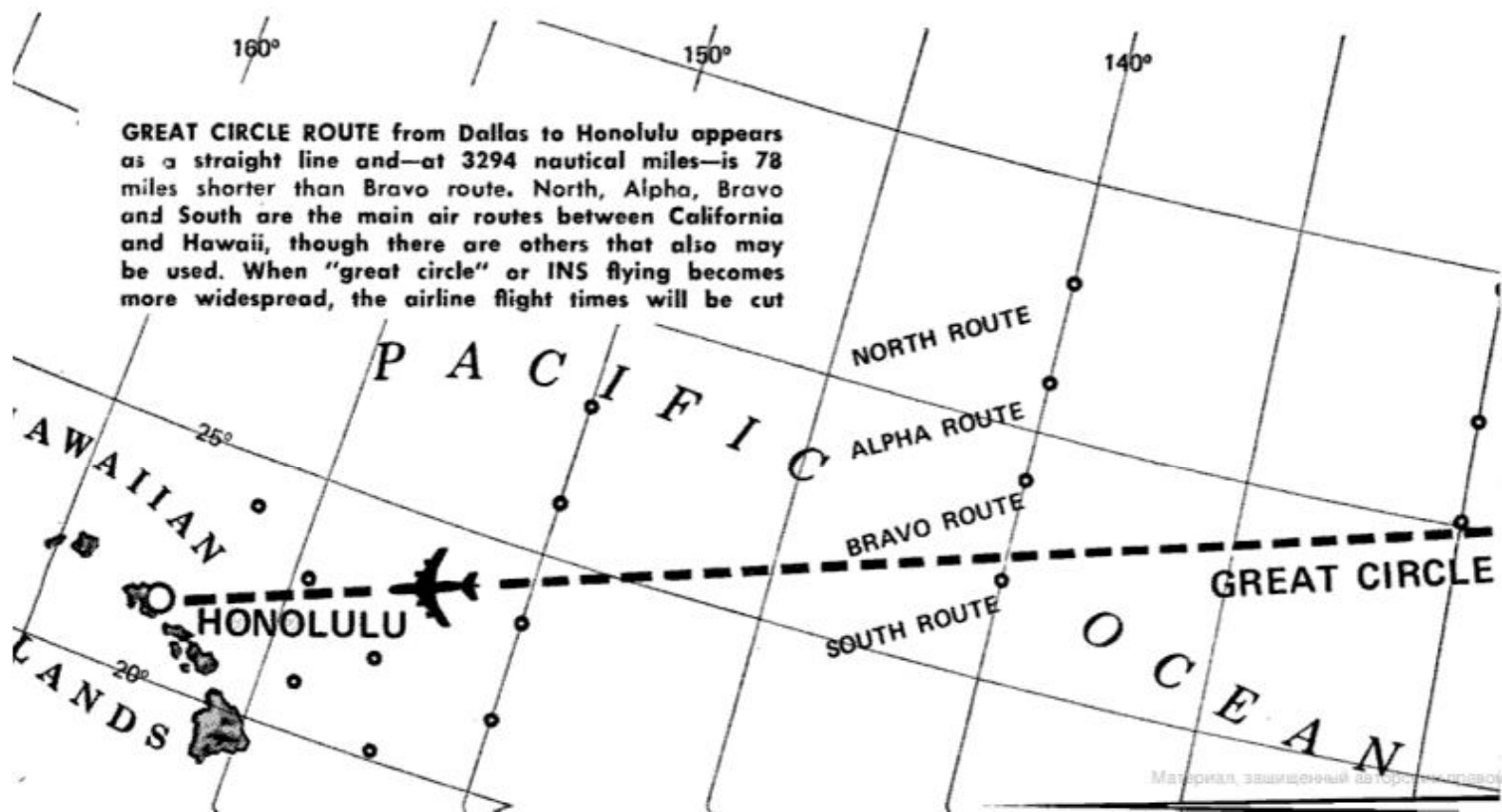
make it practical and economical enough for commercial use. Three accelerometers small enough to be held in the palm of a hand precisely measure changes in velocity of the aircraft. They are mounted on a platform stabilized by three small gyros spinning at 24,000 rpm. The platform remains rotationally fixed in space, no matter what changes the aircraft happens to make about its three axes.

Accelerometer signals are fed to a digital computer which keeps track of time and each change, however minute, in speed and direction.

Operation of the INS requires little special training. While Doppler/Loran crews spend up to two weeks in a classroom and fly 50 to 100 hours under the supervision of a navigator in the process of being “rated,” INS theory and practice can be explained in two days of school and two hours in the cockpit simulator.

One overwater hop should fully qualify a pilot to operate on his own with the Carousel IV.

During preflight checks a crew must “tell” the INS where it is by inserting into its computer the exact position of the airplane. This must be accomplished while the plane is parked and at least 15 minutes prior to departure for the system to properly align itself. Then the latitude and longitude of the destina-



tion are inserted, along with coordinates of up to nine "waypoints." A flight from Dallas to Honolulu is not programmed from city to city, or airport to airport, but from its gate at Dallas to its gate at Honolulu. It is that precise. The INS is "told," in effect, "Guide us from Gate 12 at DAL to Gate 29 at HNL." An experienced crew can complete the setup for any flight in five minutes.

The INS is self-contained and does not require any outside magnetic, radio or radar inputs. It provides course data in degrees from true North and is totally unaffected by the continuously changing variation that complicates all magnetic systems of navigation. It always navigates along a great circle route (a string connecting any two locations on a globe approximates a "great circle"—the shortest distance between these locations).

This is not to say that present Dallas-Honolulu flights are operating along great circle routes. Such a flight would cross northern Mexico, several areas reserved for military use and conflict with the four primary airways currently employed for California-Hawaii traffic. At this writing, relatively few airliners are equipped with INS and they must often fit into the flow of Doppler-equipped aircraft. The FAA is current-

ly establishing a new domestic network of routes between major terminals to allow INS users to cut corners and fly straight through on a regular basis.

As INS comes into more general use traffic control methods will be further modified, allowing INS trips to fully exploit the system's unique possibilities. Ideally, all INS-directed flights would fly great circle routes from takeoff to landing. Today a Dallas-Honolulu schedule must usually make 15 to 20 heading changes to comply with a routing that takes it across Los Angeles, 200 miles north of the shortest way to Hawaii. In cruise, a 747 burns about 400 pounds of fuel a minute; anything that can reduce a flight by 5 minutes, or 10 or more, adds up to significant savings in operating costs. INS will eventually make such savings possible to all airlines.

After takeoff a flight is normally vectored by radar to its assigned route,

(Please turn to page 204)

IT'S SMALL, but this inertial reference unit can sense every movement of the giant 747 airliner





'Bubble-Top' VW

The addition of the top half of a Volkswagen sedan to a VW bus results in a sort of bubble-top camper that's high enough for occupants to stand up inside.



Bridge is obstacle course

Irish traffic authorities create "obstacle courses" on bridges that can't stand the strain of high-speed traffic. Vehicles must slow to five mph to negotiate the zigzag path; thus vibration is cut down.



Farming by remote control

Demonstrated in Switzerland, this automated farm tractor can perform some 20 jobs by radio control. The technician in the foreground operates the control panel. Maker of the tractor says that one farmer could control several tractors in his fields.



British Leyland's electric

This prototype of an electric car is by British Leyland. It has a plastic body and top speed of 32 mph. The car has no gears and is powered by heavy lead acid batteries that weigh over 600 pounds. Maximum range is 40 miles before recharging.

Giant 'model' railroad

Locomotives stand five feet tall, weigh about five tons and haul about a dozen cars per trip on the Romney, Hythe and Dymchurch Light Railway across the Kent marshes of England. The railroad, built in the late 1920s, has 14 miles of track and is described as the smallest privately-owned railway in the world. Passengers sit two abreast in the coaches, protected from the weather. Some 350,000 passengers ride the railway each year. Its nine locomotives are replicas of steam engines that ran on British main lines until diesel and electric trains took over.





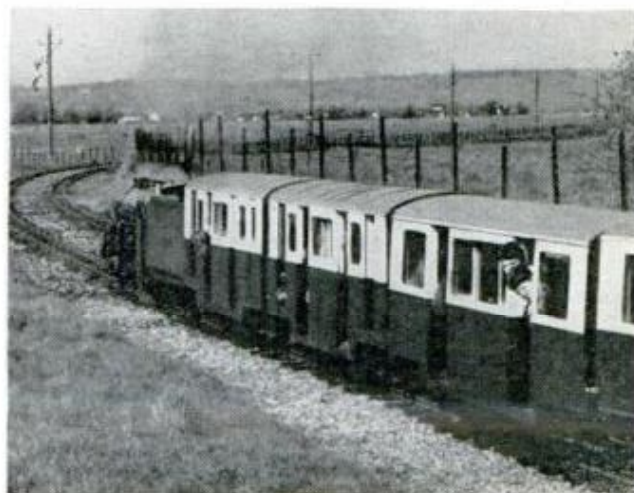
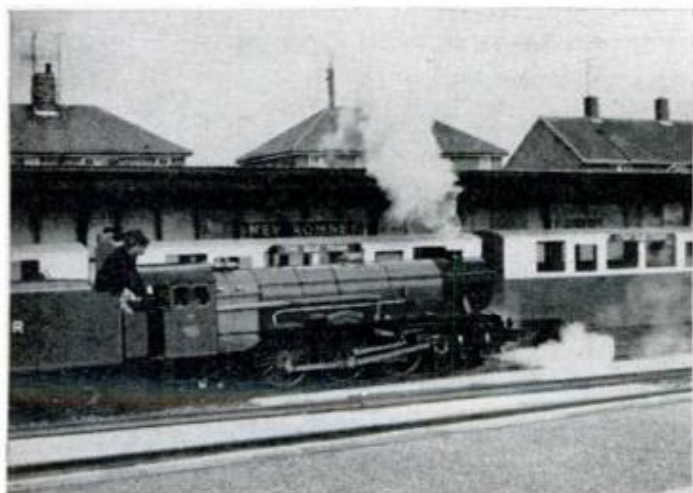
'Police Car of Tomorrow'

Equipped to handle virtually any emergency, the "Police Car of Tomorrow" is a four-door Plymouth customized by Federal Sign & Signal Corp. as an ideal law-enforcement vehicle. The car is being displayed throughout the country. Among its features are see-through roof, front-mounted push-bar for moving disabled vehicles from the road, and TwinSonic visual-audible warning unit on the roof. In the trunk (upper right) are such items as a kit for prying open disabled vehicles, maternity kit and gas grenades and launcher. One of the electronic devices at the console (right) is VASCAR, a speed-timing computer.



Navy trainer reappears as counterinsurgency craft

Formerly a Navy jet trainer, the Temco-designed TT-1 is now being produced by American Jet Industries as a more powerful trainer and/or counterinsurgency fighter called Super Pinto. Its Mach limit is .76. Extra tanks (shown) were for a long-distance speed run.



OCTOBER 1971

113

CARS

'Drunkometer' Device

WASHINGTON, Nov. 21 (Reuters) — The Government notice to autom

The action follows an advertising campaign by

Cost of Bumper System Over \$100, Senate Told

Thus, this fall, for the first time in many years, there

GM Says Owner Won't Profit From Better Bumpers

WASHINGTON, April 14 — Trans

U. S. To Require Uniform Bumper Height

The biggest styling changes in the industry are planned by the Ford

Ford Says Safer, Cleaner Cars Will Cost Consumer More

As for Ford company officials there recently would

Car Buffs Oppose U. S. Speed Curbs

Speaking of safety, Ford is also adding side

Era of Big, Annual Styling Changes is Almost Over

Reason for this is that the companies

Nader Prods FTC To Probe Legality of Styling Changes

GM has next to nothing scheduled in the way of styling changes this fall. The

'72 Cars:

By BILL HARTFORD
Auto Editor

THERE OUGHTA BE A LAW," say those of us who want to be protected from something. But when it comes to laws that will protect us from ourselves, we're not very enthusiastic.

We proved it by our appalling disregard for the automobile safety legislation of the past several years: Thousands of lives are wasted in automobile accidents each year because government-required safety belts are not being used. The needed incentive, all that would be required to get most of us to belt up, is simply a law that says you must buckle up.

Such an obvious solution is, sadly, not good politics, and, so, safety legislation continues to be directed almost exclusively at the vehicle (you don't hear much about improved driver training and laws for breakaway light poles near roadways). Currently, officialdom's cry is for a passive restraint system (with the Highway Traffic Safety Administration high on air bags), for stronger bumpers at a uniform height, for speed controls, even for a possible check-out gizmo to prevent intoxicated (and otherwise flus-

or Teetotalers, Too?

ence was offered last test the predic
o suggest that a were c
predict b

Here Comes the Air Bag:
Like It or Lump It

In a speech delivered at the Bab- the use of common par
Founder Day the models

What Price Auto Safety?

Transportation Secretary
John A. Volpe gave notice of
a proposed that would

and to eliminate bumper de-
signs that might

different
ceptible

Why You Should Buy Now

tered persons) from starting their cars.

There are many examples of cost-effective safety features in today's cars (collapsible steering columns, side-beam protection, accident-proof door locks and so on). And no one will dispute the need for continuing research and development in automotive safety. But it is also clear that, without a careful approach to what we're getting for what we're paying, in a few years the government may have saved us from ourselves by making it impossible to afford to buy a new car! The list of safety-related improvements is endless, but what price auto safety?

Consider the legislation of a more crash-resistant bumper system. It's not just a new bumper: The chassis must be beefed up for the additional energy absorption and weight. The first safety-bumper cars, the '73s, will have a system designed for five-mph collisions. Sticker price will be up around \$100 just for this protection. Will it be worth it? Maybe not unless you have a five-mph collision within the number of years it takes to realize the \$100 from *promised* savings on your auto collision insurance. In a more severe collision, what will it cost to replace

the bumper system? You can bet a lot more than your present bumper. In 1974 the bumper standard will be even more stringent and include uniform bumper height.

How about air bags? If '74 model-year legislation stands up in court (it's now being challenged by domestic and import automakers), you'll be forced to buy a car equipped with this possibly inadequately developed device—and pay the price. You'll especially resent such automotive taxation without representation if you faithfully use shoulder-lap belts.

If you buy a car for its styling, your reason for buying is becoming a thing of the past. Fine if you hold to a VW philosophy, but possible legislation may restrict your choices.

Are you hooked on convertibles? Get one now; they're fast going the way of the dodo bird. Rumor is GM's intermediates will be next—gone in '73.

Add to the high price of safety the cost of future air-pollution control hardware, and, what someone humorously suggested, starts to sound like a practical idea: Even if you don't need it, buy a '72 now, put it on blocks and break it out in '75!

★★★



MATADOR FOUR-DOOR SEDAN AND TWO-DOOR HARDTOP

AMC Gets It All Together

The small company, last in sales, tackles the big job of putting workmanship first

By ROBERT LUND, Detroit Automotive Editor

Photos by Bruce Moss

THE best cars out of Detroit this year in terms of the way they're put together may come out of Wisconsin. That's where American Motors makes 'em.

How can a little company claim to build them better than a big company? Because it's a little company. Because it doesn't build as many cars, in numbers or models, or build them as fast as a big company. In a small, tight operation, there are fewer chances of making mistakes.

That's not a prediction that AMC's '72s will be the best cars on the road. "Best" takes in a lot of territory other than the way they're assembled. Everybody has his own idea of how many points to assign for styling, engineering, handling, service, gadgetry and what the bill will come to when the dealer finally feeds it through the adding machine.

But if you score high on your per-

sonal scale for the way the pieces fit together, AMC says it's got the goods. "I don't claim we've magically and finally licked all the problems of the assembly line," Gerald Meyers, vice-president in charge of product development, admits. "We can't do that any more than any other company. But we sure as hell have licked a lot of the problems.

"We lined things up on a priority basis, items that are important to car buyers, whatever they drive. Then we rated our cars on those items. We didn't try to kid ourselves. In too many cases we had to admit we weren't doing as well as we should. So we stamped 'Go' on whatever it took to make them better."

Meyers uses his fingers to tick off the major moves AMC's made for '72:

- Reduced the product line from 21 cars to 15. All low-line jobs have been dropped. "No more 'strippies.'" Meyers



HORNET

GREMLIN



AMBASSADOR



JAVELIN AMX

explains. "We're going bottomless for 1972."

- Upgraded the 15 surviving cars. Some gear you used to pay extra for has been made standard.

- Worked its cars over virtually from scratch looking for ways to improve them. This project, AMC says, led to 102 engineering changes. Not visual wrinkles. Strictly working pieces.

Several changes apply to all cars.

There's a new (to American Motors) automatic transmission. AMC calls it Torque-Command. AMC buys the unit from Chrysler. It's an improvement on the automatic the company used to offer because it doesn't require band adjustment and you don't have to change oil under normal driving.

Electric windshield wipers and washers have been made standard on all cars, replacing the vacuum type.

You can get disc brakes on all cars, whether the engine's a Six or an Eight. They cost extra, of course.

If you order a radio, you get a stub antenna—it retracts to three inches—preset at the factory for best reception. The antenna used to be installed by dealers on AMC cars.

As an antitheft measure, an inside-the-car hood release is available on all AMC products.

In the safety area, the company has instituted a policy of testing brakes of all cars before shipping them to dealers, an idea other producers might emulate.



JAVELIN SST changes for '72 include new cross-hatch, rectangular grille and optional rally stripes

Calling 'em off by name, here's how they've changed:

AMBASSADOR: Power drum brakes and an inside hood release lock have been made standard. "Full factory equipment," one of those vague phrases that doesn't mean what the dealers would like you to think it means, counts for something on Ambassador. In addition to power brakes, you still get air, an automatic transmission and a V8 in the standard package.

Heater and airconditioning controls are now vacuum-actuated, eliminating the need for cable adjustment. There's a new plug-in socket for the main wiring harness, making it easier to service. An air outlet's been added on the left of the instrument panel to improve the flow of fresh air. Fuel-tank capacity on wagons has been increased from 17 gallons to 20.

The company has made some sparing

(Please turn to page 206)

1972 AMERICAN MOTORS SPECIFICATIONS

Car	Body Style	Wheel-base (in.)	Overall Length (in.)	Overall Width (in.)	Track (f/r in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
Gremlin Hornet	2-dr sedan	96.0	161.3	70.6	57.5/57.0 ¹	236-6-1bbl., 258-6-1bbl., 304-2bbl.
	2-dr. sedan, 4-dr. sedan, Sportabout	108.0	179.3	70.6	57.5/57.0 ¹	232-6-1bbl., 258-6-1bbl., 304-2bbl., 360-2&4bbl.
Javelin	2-dr. hdtp.	110.0	191.8	75.2	59.3/60.0 ³	232-6-1bbl., 258-6-1bbl., 304-2bbl., 360-2&4bbl., 401-4bbl.
Matador	2-dr hdtp., 4-dr. sedan, wagon	118.0	206.1 ²	77.2	59.9/60.0	232-6-1bbl., 258-6-1bbl., 304-2bbl., 360-2&4bbl., 401-4bbl.
Ambassador	2-dr hdtp., 4-dr. sedan, wagon	122.0	210.8 ⁴	77.2	59.9/60.0	304-2bbl., 360-2&4bbl., 401-4bbl.

*Not all engines available in all models

1, 57.2/56.6 V8 models; 2, 205.0 wagon; 3, 59.7/60.0 V8 models; 4, 209.7 wagon



'72
CARS

GM Holds the Line

No eye-popping changes but it's still a bumper crop

By MICHAEL LAMM, West Coast Editor

GENERAL MOTORS had hoped to bring out a completely redesigned series of intermediates in all 1972 lines, but last year's strike scotched those plans until 1973.

Most GM nameplates had been restyled for 1971, so there's not too much that's strikingly different about the '72s. Then, too, cries of corporate irresponsibility plus public and governmental clamor for more safety and less smog have sent GM engineers scurrying to fight those battles. Which cut deeply into the time ordinarily spent on revamping, restyling, restructuring and re-engineering overall car lines.

As a result of these trends: 1) GM is soft-pedaling 1972 horsepower ratings even more than for 1971. Chevrolet handed out some last-minute information that revised its initial figures (downward). 2) There's been a lot more effort put into reliability, crash protection, manufacturing methods, safety and emissions than ever before—this in all divisions. 3) GM has seen a mild weeding out of series and body styles, to wit: Chevy dropped the SS

Monte Carlo for '72; Pontiac is down five models and no longer makes the inexpensive T-37 Le Mans or the Le Mans Sport. The GTO now becomes a Le Mans option package. Olds is down three series and has discontinued the Delta Custom; also lists the 4-4-2 as a Cutlass option. Buick has reinstated the Skylark 350 (dropped for 1971).

Hardware changes, minor as they are, include: 1) Facelifts all around, but only devotees will be able to tell a 1971 from its 1972 counterpart. 2) Stronger bumpers on all GM full-sized cars, including several that roll with the punch. But most lines still go with standard bumpers. 3) "Wet look" vinyl roofs plus more emphasis on sunroofs from some divisions.

Now here's a make-by-make rundown of all 1972 GM offerings.

CHEVROLET: The big Chevy got the Caddy look for 1971. Some GM officials let out a corporate groan—looks too opulent, they said; not in keeping with Chevy's status. Maybe so, but for '72, Chevrolet's Cad look remains, is refined, and the car's ride turns out to



PONTIAC FIREBIRD



OLDSMOBILE 442



PONTIAC GTO



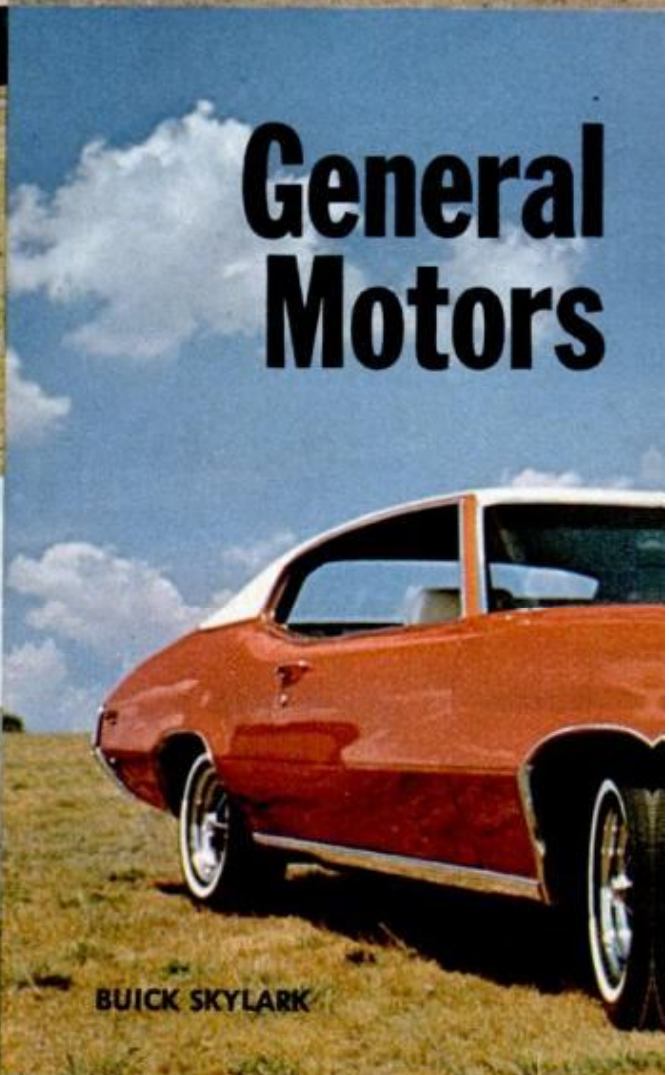
CHEVROLET MONTE CARLO



PONTIAC GRAND SAFARI



BUICK CENTURION



BUICK SKYLARK



CHEVROLET VEGA



General Motors



CHEVROLET NOVA



BUICK RIVIERA

'72 CARS



OLDSMOBILE DELTA 88



OLDSMOBILE TORONADO



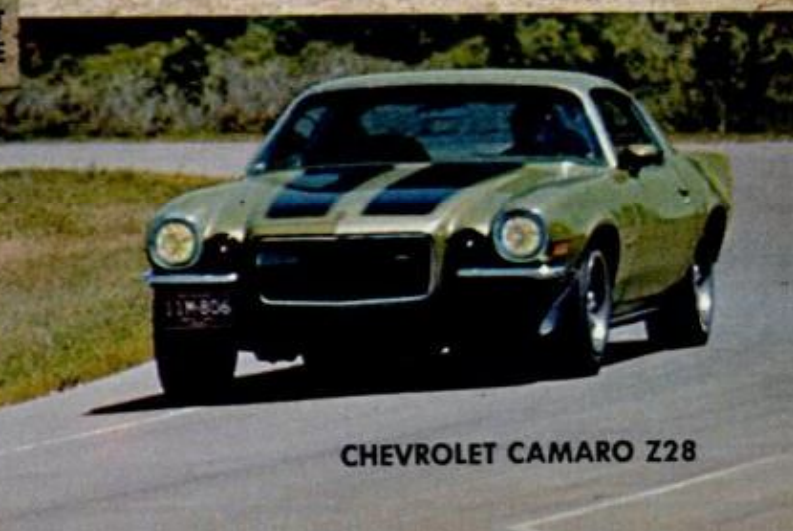
CHEVROLET CAPRICE



PONTIAC GRAND VILLE



CHEVROLET CORVETTE



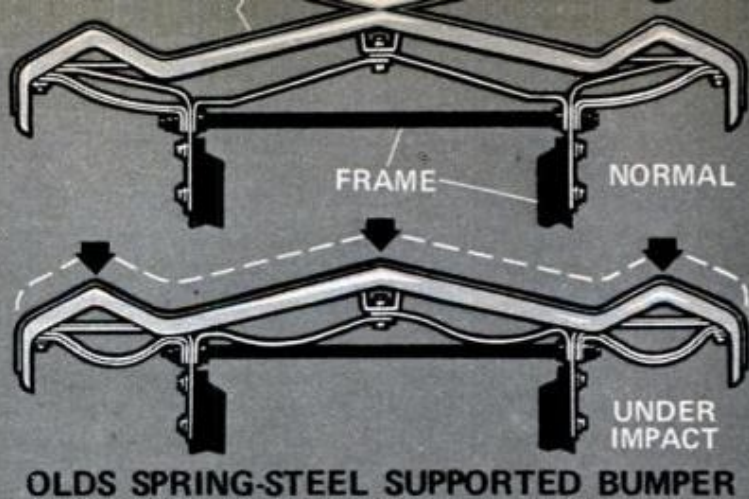
CHEVROLET CAMARO Z28

1972 GENERAL MOTORS SPECIFICATIONS

Cars	Body Style	Wheel-base (in.)	Overall Length (in.)	Overall Width (in.)	Track (f/r in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
Chevrolet Vega	2-dr. sedan, coupe, wagon, delivery	97.0	169.7	65.4	55.1/54.1	140-4-1&2bbl.
Chevrolet Corvette	2-dr. coupe, convert.	98.0	182.5	69.0	58.7/59.4	350-2&4bbl., 454-4bbl.
Pontiac Firebird	2-dr. coupe	108.0	191.6	73.4	61.6/60.3	250-6-1bbl., 350-2bbl., 400-2&4 bbl., 455-4bbl.
Chevrolet Camaro	2-dr. coupe	108.0	188.0	74.4	61.3/60.0	250-6-1bbl., 307-2bbl., 350-2&4 bbl., 396-4bbl.
Chevrolet Nova	2-dr. coupe, 4-dr. sedan	111.0	189.4	72.4	59.1/58.8	250-6-1bbl., 307-2bbl., 350-4bbl.
Pontiac Ventura II	2-dr. coupe, 4-dr. sedan	111.0	194.5	72.4	59.0/58.9	250-6-1bbl., 307-2bbl.
Chevrolet Chevelle	2-dr. coupe, convert., 4-dr. sedan, wagon	112.0 116.0 ¹	197.5 201.5 ¹	75.4	60.0/59.9	250-6-1bbl., 307-2bbl., 350-2&4 bbl., 400-4bbl., 454-4bbl.
Pontiac Le Mans	2-dr. coupe, hdtp., convert., 4-dr. sedan, hdtp., wagon	112.0 116.0 ¹	202.8 206.8 ²	76.7	61.0/60.0	250-6-1bbl., 350-2bbl., 400-2&4 bbl., 455-4bbl.
Buick Skylark	2-dr. coupe, hdtp., convert., 4-dr. hdtp., sedan	112.0 116.0 ¹	203.3 207.3 ¹	76.8	59.3/59.3	350-2&4bbl., 455-4bbl.
Oldsmobile Cutlass	2-dr. coupe, hdtp., convert. 4-dr. hdtp., wagon	112.0 ³ 116.0 ⁴	203.6 ³ 213.3 ⁴	76.8	59.7/59.0	350-2&4bbl., 455-4bbl.
Chevrolet Monte Carlo	2-dr. coupe	116.0	206.5	75.6	60.3/59.3	350-2&4bbl., 400-4bbl., 454-4bbl.
Pontiac Grand Prix	2-dr. coupe	118.0	213.7	76.4	62.0/60.0	400-4bbl., 455-4bbl.
Buick Riviera	2-dr. coupe	122.0	218.3	80.0	63.6/64.0	455-4bbl.
Oldsmobile Toronado	2-dr. coupe	122.0	220.6	79.8	63.5/63.6	455-4bbl.
Cadillac Eldorado	2-dr. coupe, convert.	126.3	223.2	79.8	63.5/63.0	500-4bbl.
Chevrolet	2-dr. coupe, convert., 4-dr. sedan, hdtp., wagon	121.5 125.0 ⁵	219.9 225.2 ⁵	79.5	64.0/64.0	250-6-1bbl., 350-2&4bbl., 400-2 &4bbl., 454-4bbl.
Pontiac Catalina (Grande Ville)	2-dr. hdtp., convert., 4-dr. sedan, hdtp., wagon	123.5 126.0 ⁶ 127.0 ⁷	222.4 226.4 ⁶ 228.2 ⁷	79.5	64.0/64.0	400-2&4bbl., 455-2&4bbl.
Buick Le Sabre (Centurion)	2-dr. coupe, convert., 4-dr. sedan, hdtp.	124.0	221.9	80.0	63.6/64.0	350-2&4bbl., 455-4bbl.
Oldsmobile Delta 88	2-dr. coupe, hdtp., 4-dr. hdtp., sedan	124.0	222.1	79.5	64.1/64.0	350-2bbl., 455-2bbl.
Buick Electra	2-dr. coupe, 4-dr. hdtp.	127.0	227.9	80.0	63.6/64.0	455-4bbl.
Oldsmobile 98	2-dr. coupe, 4-dr. hdtp., wagon	127.0	227.8 227.0 ⁸	79.6 79.5 ⁸	64.1/64.0 63.8/63.7 ⁸	455-2&4bbl.
Cadillac	2&4-dr. hdtp., 4-dr. sedan, 4-dr. sedan, limousine	130.0 133.0 151.5	227.4 230.4 248.9	79.8	63.0/63.0	472-4bbl.

*Not all engines available in all models

1, 4-dr. models, wagon; 2, 4-dr. sedan, LeMans wagon 210.9; 3, "S" coupe, 4-4-2; 4, F-85, Cutlass, Supreme (Cutlass wagon length 213.3, Vista Cruiser wb 121.0, length 218.3); 5, wagon; 6, Bonneville, Grand Ville; 7, wagons; 8, Custom Cruiser wagon



OLDS SPRING-STEEL SUPPORTED BUMPER



OUTDOOR THERMOMETER is a gee-whiz option on all 1972 Oldsmobile models

BUMPER DISPLACEMENT under impact is provided by spring-steel bumper-mounting system on front of all full-size Oldsmobiles

be even quieter and smoother than last year.

All V8 models now make Turbo Hydra-Matic standard equipment, and likewise with variable-ratio power steering. The flow-through ventilation system has been revamped so cold air no longer backs up into the rear-seat area. A few owners complained about that in 1971.

The big Chevy's front bumper is heftier than before, with rugged reinforcing framework behind it and a rubber impact strip out front. Altogether, though this bumper is rigid, it withstands a 2.5-mph barrier impact without damage.

In other series, the Vega gets a glove-box door (the Vega shown in color on page 120 is a special custom job: The Yenko Turbo-Stinger); the Nova remains virtually unchanged; Camaro likewise except for minor trim differ-

ences; Chevelle's grille has been revamped slightly; and the Corvette, since it's the nation's favorite for car thieves, now has an antitheft alarm as standard equipment.

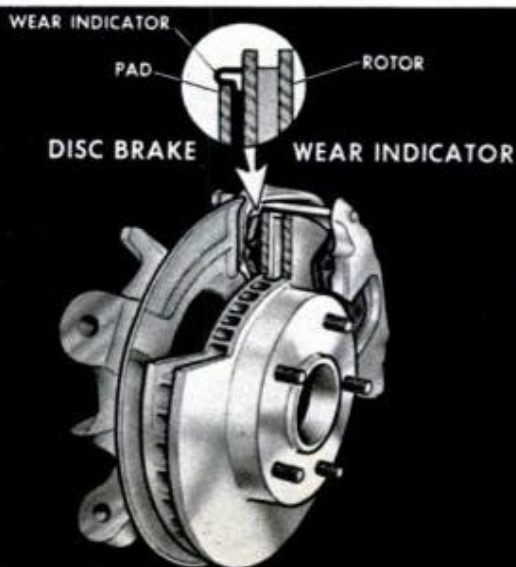
PONTIAC: Pontiac also made some big changes in '71, thus little ones for '72. One important 1972 addition, though: a plush Luxury Le Mans in the intermediate series. The 1972 GTO, however, since owners were finding it hard to get insurance, has been made an option package for the Le Mans coupe and two-door hardtop, with fewer horses. The GTO's base price is less now, thanks to thinning out the standard equipment. Also dropped: the T-37 Le Mans coupe, probably because it competed with the Ventura II.

Big Pontiacs have energy-absorbing front bumpers that let you crash into other cars at five mph without damage

(Please turn to page 210)

WEAR INDICATOR, on front discs of the Toronado, will soon be on all of GM lines

LUXURY LE MANS addition is among changes in the Pontiac intermediate lineup. T-37 is dropped, GTO is an option package





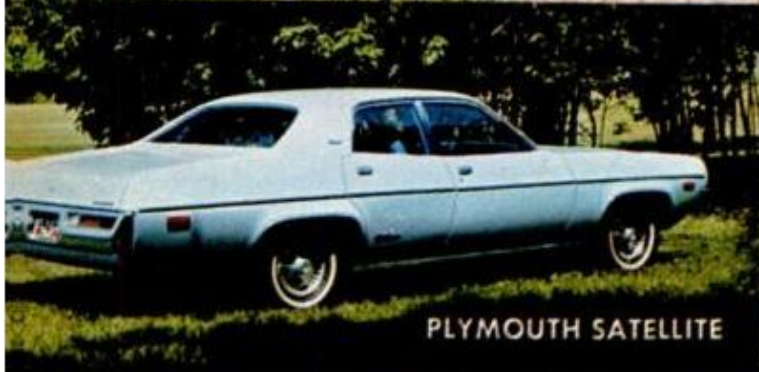
**DODGE
COLT**



**PLYMOUTH
CRICKET**



DODGE CHARGER



PLYMOUTH SATELLITE



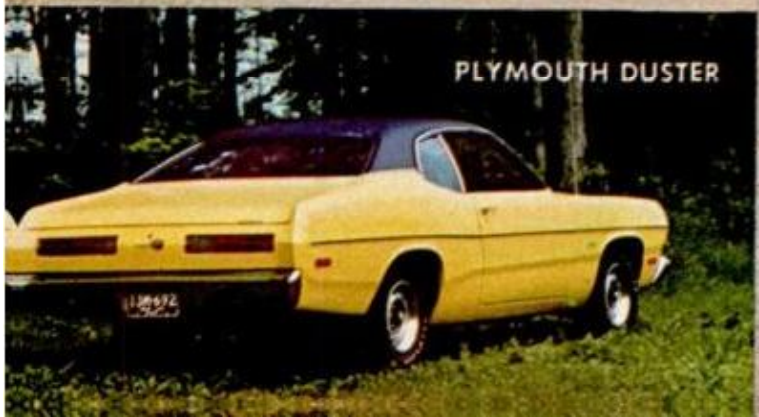
DODGE POLARA



DODGE CHALLENGER



PLYMOUTH BARRACUDA



PLYMOUTH DUSTER



DODGE DEMON

THERE'S A SAMENESS that makes sense about Chrysler's '72 cars. That sounds like a contradiction, because similarity and sameness are supposed to be sins in automaking. At least in styling. But what about other areas?

What Chrysler's done for '72 is apply certain improvements to all its cars. Across the board, regardless of price. So what's new about that? Standard practice in bringing out a new item or improvement is to limit it to the highest priced cars for a year or so, then offer it as an extra-cost option on the plainer pieces. Chrysler's decided if it's good enough for Imperial, Plymouth should have it too. Within reason, of course. (Don't misread the company's motive. It has nothing to do with

Chrysler Sets Some Standards

'72 CARS

On all the company's car lines, the switch is on to standardize features that once were options

By ROBERT LUND, Detroit Automotive Editor

Photos by Bruce Moss

corporate altruism. It's the old mass production principle—the more you standardize, the lower your costs per unit.)

Here's a list of better or new items standard on all Chrysler cars for '72 except the two imports, Cricket and Colt:

Headlights and back-up lights: They're brighter, throw more light on the road and are better directed.

Trim: All exterior brightwork—lamps, grilles, door handles, bumpers and ornaments—is treated by a new process the company calls “discontinuous chromium plating.” The process distributes anticorrosive elements over a larger area, providing better protection against chemical attack and rust.

Bumpers: They've been beefed up to take more impact. Chrysler isn't saying how much more. Just more.

Radio antenna: Made of solid stainless steel, the antenna is permanently fixed at 31 inches. It doesn't telescope. The neighborhood vandals won't be able to snap it off as easily as they did the old version and you don't have to worry about it being clipped off going through a car wash.

Seats: Seat tracks are made of a heavier gauge steel so the seat's less likely to break loose if you get socked from the rear.

Seat belts and shoulder straps: Belt and strap attach to a single buckle. Neater and you don't have to fumble around as much to lash yourself in.

Alternator: Solder joints have been eliminated, heavier diodes are used and capacitor mountings have been strengthened. The unit's easier to install and service and should require less service.

Litter bags: Two-quart size made of plastic; there's one in every car.

New but not standard on all cars:

Chrysler has a new optional engine the company refers to as “a compromise between muscle and economy.” Replacing the old workhorse 383-c.i.d., the new



CHRYSLER TOWN AND COUNTRY wagons have new auto-lock to lock tailgate door when ignition is on

job is a 400-c.i.d. V8 with an 8.2 to 1 compression ratio and comes in two-barrel or four-barrel versions. Bore has been increased to 4.34 inches from 4.25. Stroke remains the same—3.38 inches. Chrysler says the new plant is a better performer and will give the same fuel results as the 383.

The ignition system has been im-



PLYMOUTH FURY has new 400-cu.-in. V8 as an option. Compression ratio is 8.2:1 for regular fuel

proved on the 360-c.i.d. engine, a carry-over from previous years. Working parts in the distributor have been reduced to two bearings. The only service required is a drop of oil every 24,000 miles. The same ignition setup is used on the new 400 engine.

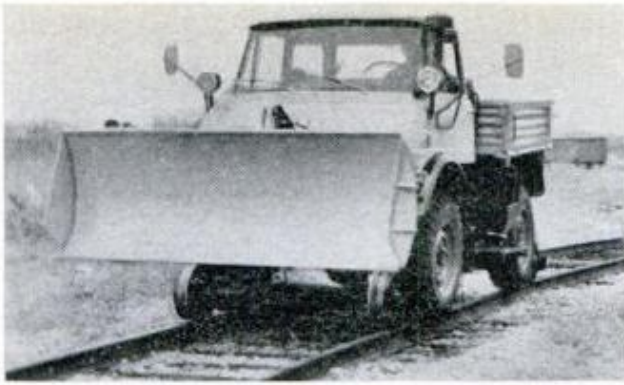
Chrysler's catalog is down to 73 mod-

(Please turn to page 206)

1972 CHRYSLER-PLYMOUTH AND DODGE SPECIFICATIONS

Car	Body Style	Wheel-base (in.)	Overall Length (in.)	Overall Width (in.)	Track (f/r in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
Dodge Colt	2-dr. hdt., coupe, 4-dr. sedan, wagon	95.3	160.6	61.8	50.6/50.6	97.5-4-2bbl.
Plymouth Cricket	4-dr. sedan	98.0	161.4	62.5	51.0/51.3	91.4-4-1&2bbl.
Dodge Demon	2-dr. coupe	108.0	192.5	71.7	57.5/55.6	198-6-1bbl., 225-6-1bbl., 318-2bbl., 340-4bbl.
Dart, Swinger	2-dr. hdt., 4-dr. sedan	111.0	196.2	69.7	57.4/55.5	
Plymouth Valiant, Duster	2-dr. coupe, 4-dr. sedan	108.0	188.4	71.0	57.4/55.6	198-6-1bbl., 225-6-1bbl., 318-2bbl., 340-4bbl.
Scamp	2-dr. hdt.	111.0	192.1	71.0	57.4/55.6	
Plymouth Barracuda	2-dr. hdt.	108.0	186.6	74.9	59.7/61.6	225-6-1bbl., 318-2bbl., 340-4bbl.
Dodge Challenger	2-dr. hdt.	110.0	191.3	76.4	59.7/61.6	225-6-1bbl., 318-2bbl., 340-4bbl.
Dodge Charger,	2-dr. coupe hdt.	115.0	205.4	76.9	59.7/61.6	225-6-1bbl., 318-2bbl., 340-4bbl., 400-2&4bbl., 440-4bbl.&(3)2bbl.
Coronet	4-dr. sedan wagon	118.0	207.0	77.7	59.7/61.6	
Plymouth Satellite	2-dr. hdt., coupe, 4-dr. sedan, wagon	115.0	203.2	79.1	59.7/62.0	225-6-1bbl., 318-2-bbl., 340-4bbl., 400-2&4bbl., 440-4bbl.
Plymouth Fury	2-dr. hdt., 4-dr. sedan, hdt. wagon	120.0	217.2	79.9	62.1/63.4	318-2bbl., 360-2bbl., 400-2bbl., 400-4bbl.&(3)2bbl.
Dodge Polara, Monaco	2-dr. hdt., 4-dr. sedan hdt., wagon	122.0	222.0	79.9	62.1/63.4	
		122.0	219.4	79.6	62.1/63.4	225-6-1bbl., 318-2bbl., 360-2bbl., 400-2bbl., 440-4bbl.
Chrysler	2-dr. sedan, hdt., 4-dr. sedan, hdt., wagon	124.0	224.1	79.1	62.1/63.4	360-2bbl., 400-2bbl., 440-4bbl.
		122.0	224.8	79.1	62.1/63.4	
Chrysler Imperial	2-dr. hdt., 4-dr. hdt.	127.0	229.5	79.6	62.4/63.4	440-4bbl.

*Not all engines available in all models



Go-anywhere switch engine

Capable of pulling a 500-ton string of railway cars, the Mercedes-Benz Unimog can then raise its guide wheels and travel anywhere. It has a diesel engine and four-wheel drive.



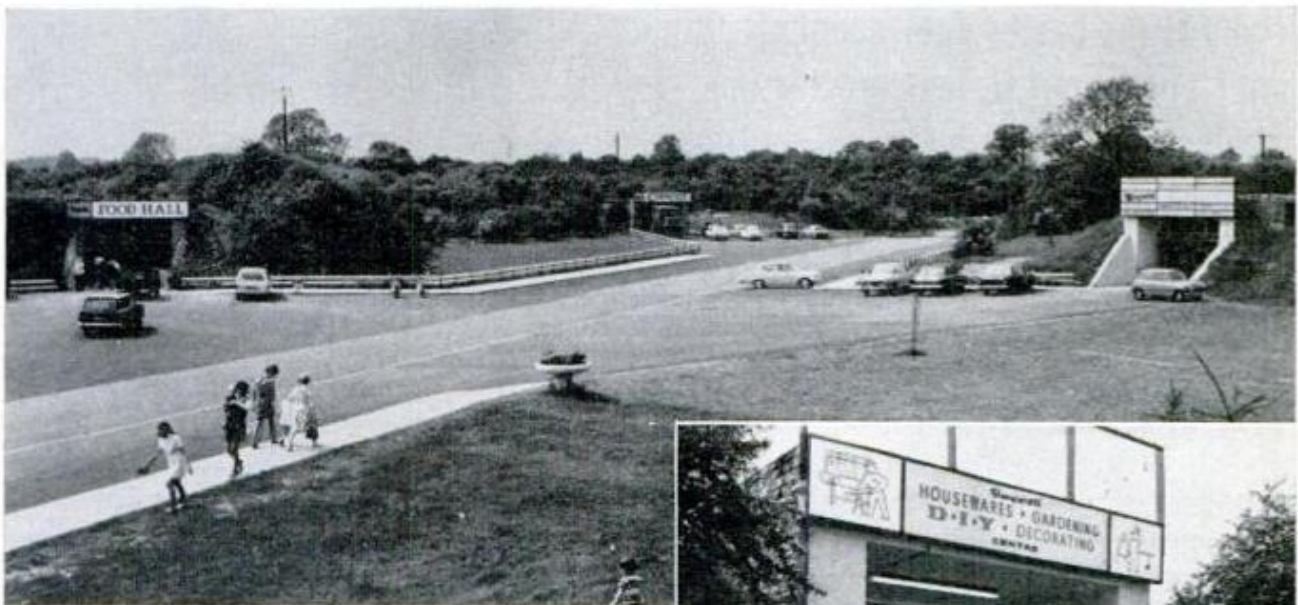
Add-ons make it a Trislander

By stretching its popular Islander and adding a third engine, Britten-Norman turned it into a Trislander (shown). It carries 18 passengers and cruises at 180 mph.



Battery-powered chair

A battery-powered wheelchair, for both outdoors and indoors, has been developed by a British firm. It's steered by a joystick that also applies electric brakes.



Shopping in bunkers

Looking for a site in which to build a shopping center, an English developer came upon an abandoned munitions factory—and converted it into a profitable cluster of stores. The 10 bunkers, each with 11,000 feet of floor space, look like ordinary, well-stocked stores inside. Landscaping of the 25-acre site has turned it into a parklike area.



WHY YOU SHOULD HOP UP YOUR IGNITION

It'll cost anywhere from \$8 to \$75, but if you want better fuel economy, longer point and plug life, easier starting, reliable ignition at high rpm and even more bonuses—do it now!

By **ROGER HUNTINGTON**

THE FACTORY ignition system on your car is designed to do one simple job at the lowest possible cost: To provide a strong spark up to the maximum shift-point speed of the transmission—usually around 4500 rpm—with no more maintenance than replacing sparkplugs and breaker points once a year.

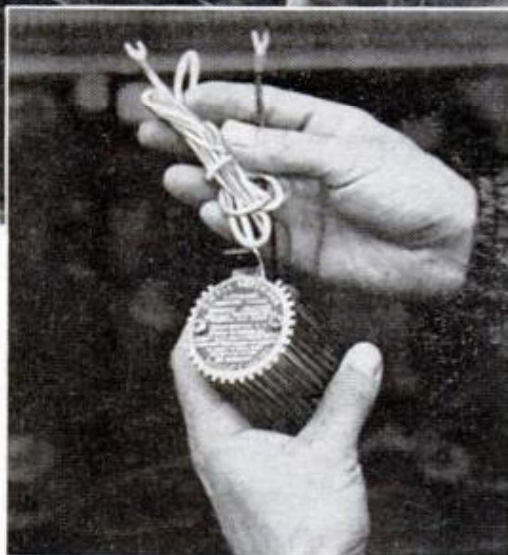
If you want more performance, the specialty equipment industry—the hot-rod business, if you will—offers literally hundreds of items that will bolt on in a few minutes, and completely transform the performance of your stock ig-

128

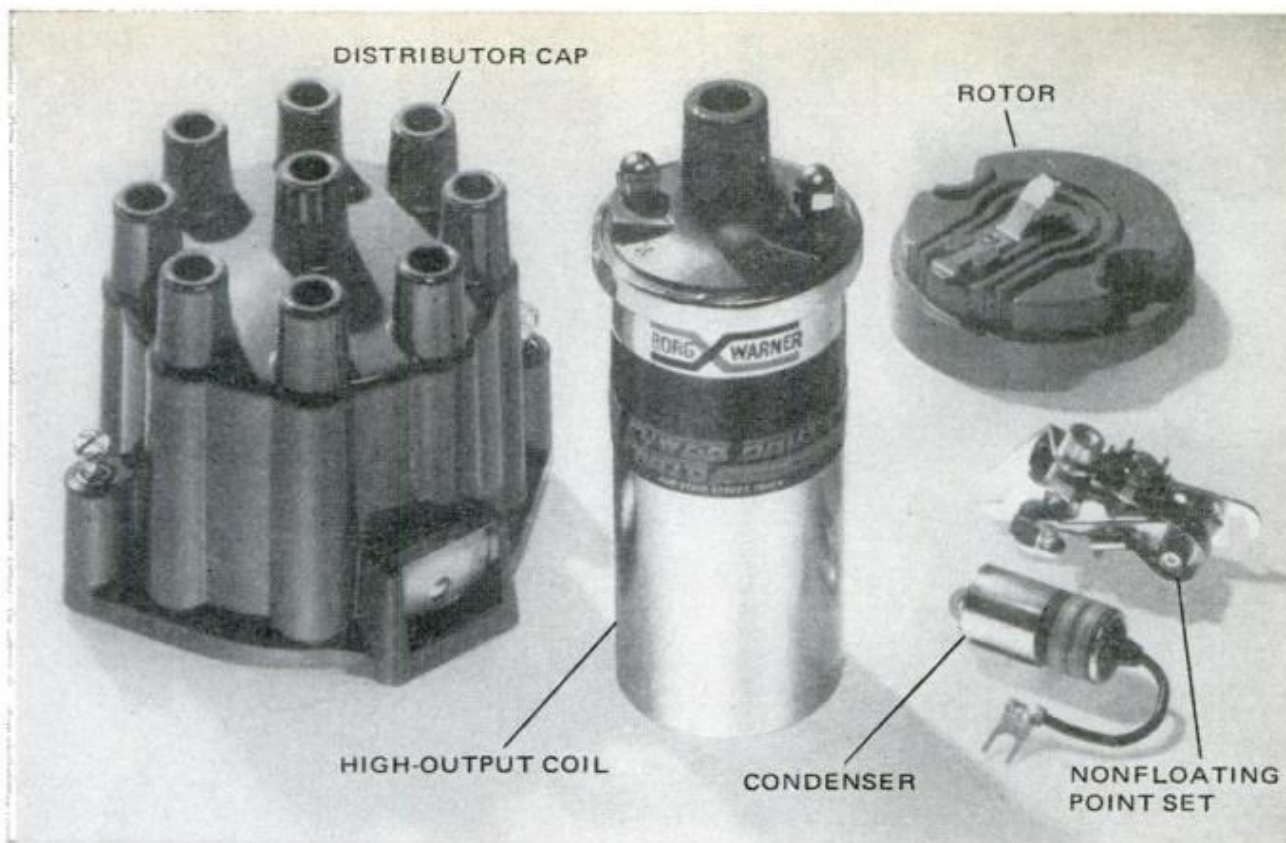
niton. You can get reliable ignition up to 10,000 rpm! You can get a modified spark advance “curve” that will pep up the engine in the low and medium speed ranges. You can get gadgets that permit you to use a set of plugs and points up to 50,000 miles. You can even do away with the points altogether. And if you're plagued with the age-old malady of most factory ignitions—missing when you punch the gas after a period of slow-speed stop-and-go driving—there's help, too.

In no area of the engine can you buy more performance improvement for

POPULAR MECHANICS



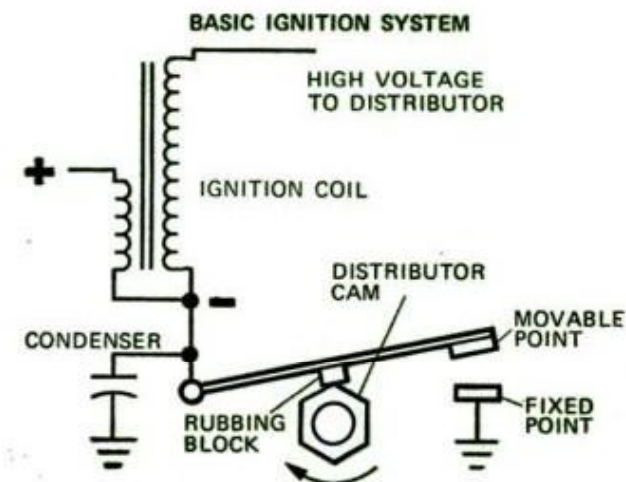
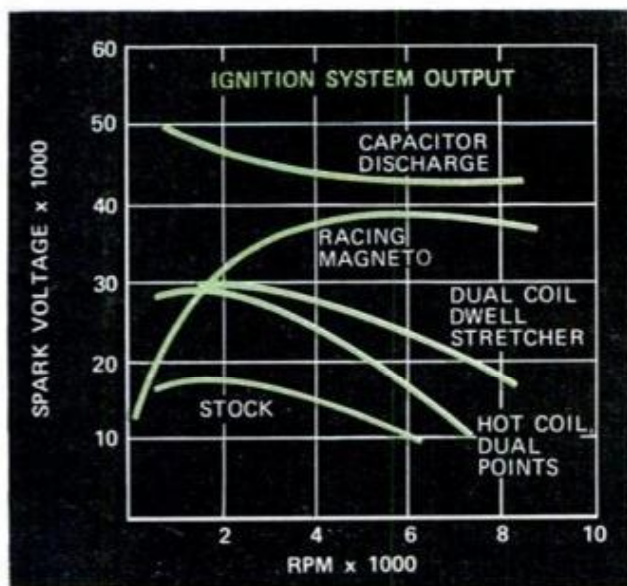
DWELL EXTENDER, this from Metrotec, is easily installed unit that provides a fuller charging of the coil for more spark energy



IGNITION HOP-UP KITS include components that replace factory ignition. This is Borg-Warner "Power Brute"

less money than in the ignition system. For example, how about extending the effective rpm range of your ignition, since most modifications help this area. Many high-performance factory engines now are capable of 6000 rpm, and stock ignitions are definitely marginal. The simplest and least expensive way to strengthen the spark at higher speeds is to install a special dual-point breaker plate in your distributor, for a price of around \$8. The principle here

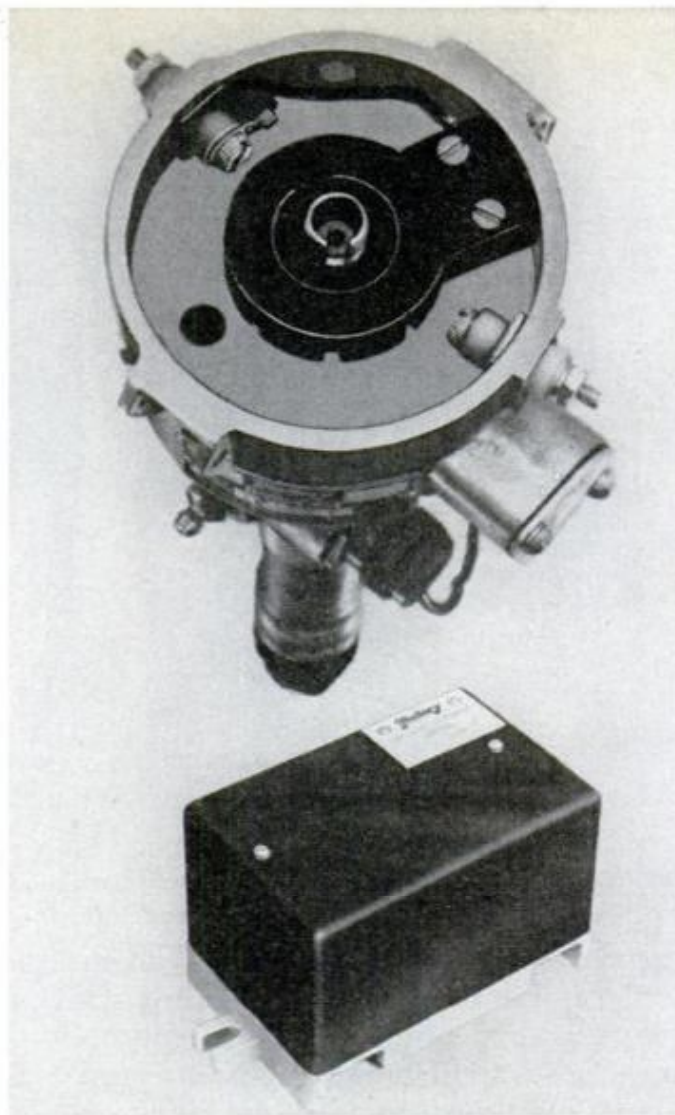
is to have the closed period of the two sets of points overlap, so the effective "dwell" period—when battery current can saturate the coil—is increased at any engine speed. This gives a hotter spark at high speeds, when the dwell period with one set of points is too short to really pump up the coil primary circuit. Some factory high-performance engines have dual points, but too often they're considered too expensive. You can buy a set at any



STOCK IGNITION SYSTEM puts out curve as shown at left. Hop-up systems improve on it; CD is the best



HIGH-PERFORMANCE DISTRIBUTOR from Crager has adjustable point plate, dual points, needle bearings



BREAKERLESS IGNITION SYSTEM from Mallory uses a light beam and photocell to trigger spark; also CD

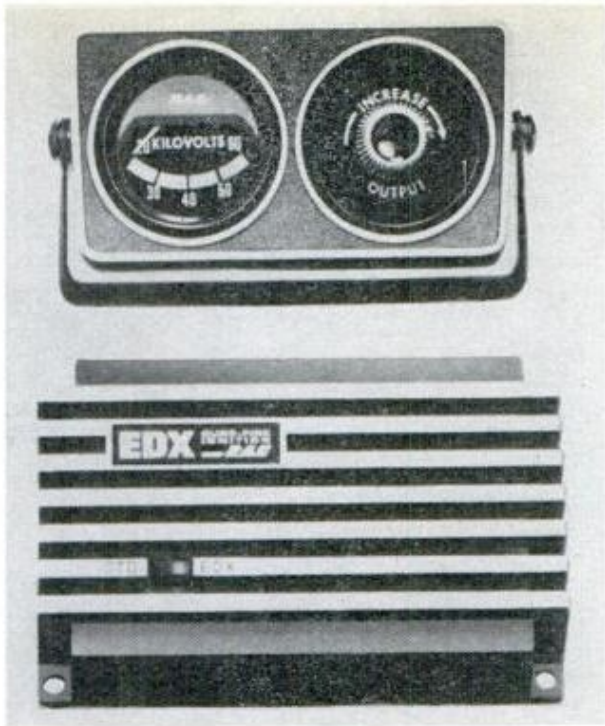
hot-rod shop and install them as easily as you would a standard replacement set.

For a few more dollars you can buy a special high-output coil to replace the standard factory coil. Stock coils, built to a price, will give you a maximum of about 15,000 volts of secondary output at lower speeds. Specialty coils have more windings, better insulation, better sealing, and core materials with stronger magnetic properties. They give 30,000 volts and more—for about twice the cost of a factory coil. In conjunction with dual points you've got an ignition system that's capable of over 7000 rpm.

Many companies offer complete ignition hop-up kits that contain all the necessary parts to rebuild a factory system into something special. Besides a

point plate and high-output coil, you generally get a quality replacement condenser, rotor and distributor cap. The rotor and cap usually are made of a high-strength alkyd material that resists carbon-tracking, with quality brass contacts for maximum spark voltage and long life. These kits just give you what the factory system *could* give if more money could be spent. I've observed the performance of several of these kits on hot street machines, and they do a tremendous job. You buy the whole thing in a box and just bolt it on in a few minutes.

The next step up is a special distributor to replace the complete stock unit. This is getting up in the range of \$50 or more. Accel's new "10,000 rpm" distributor is probably one of the most sophisticated on the market today, fea-



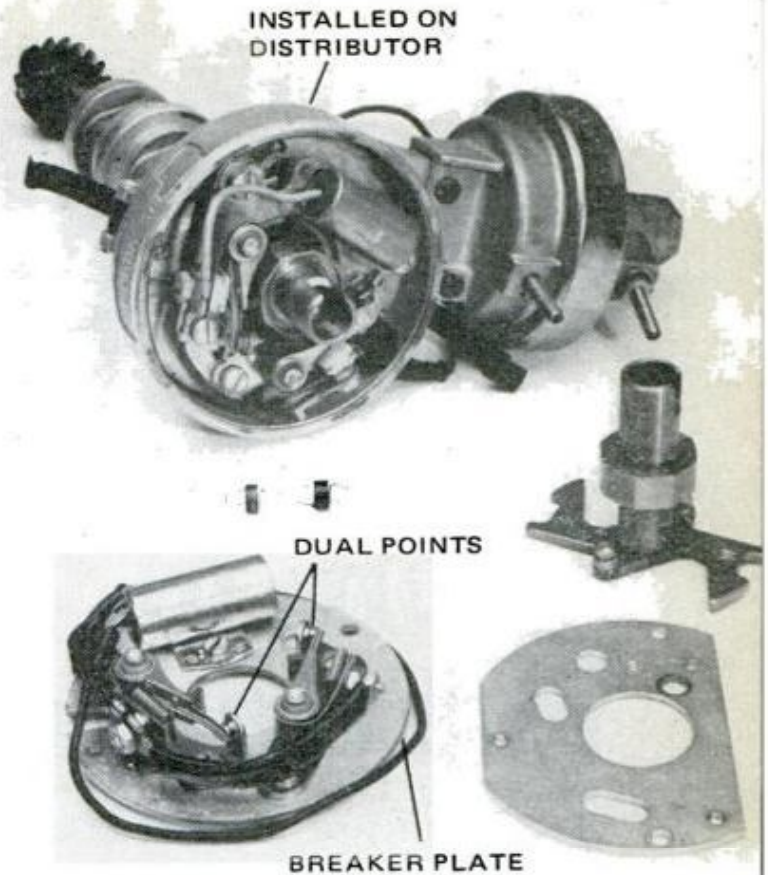
EDX (for Energy-Discharge Ignition System) is what Rite Autotronics calls its unit. Unique feature is dash-mounted voltage control unit and voltage meter

turing dual points with dwell adjustment from outside by screwdriver; double-thick, nonflexing breaker plate; close plate tolerances for accurate spark timing; needle bearings throughout for long life and minimum friction; adjustable spark advance curve that can be tailored to the engine; superior rotor and cap construction; positive sealing against moisture and dirt. Available for most popular late engines, this new distributor will slip right in to replace the stock unit.

Some specialty distributors, like the "DuCoil," are designed with four-lobe cams and opposed sets of points,



CAPACITOR-DISCHARGE IGNITION, this the Ramfire from Automotive Research Electronics, is in \$50 area
OCTOBER 1971



DUAL-POINT BREAKER PLATE is inexpensive, can be quickly installed in a standard factory distributor

to operate on two separate coils instead of one. The idea is to *double* the dwell period by putting half of the cylinders on one coil and half on the other. (You can't do this with an eight-lobe cam and one coil because there isn't enough physical space over the cam rotation.) This gives a tremendous boost in high-rpm spark voltage, almost as good as a magneto, which is strictly for racing engines. It'll give at least 8000 rpm.

Companies that make them say you can have the benefits of dual-coil ignition with a conventional system—by wiring in their little dwell-stretcher units. They use a transistorized circuit to bypass the breaker points and switch the battery current into the coil primary only a few milliseconds after the spark fires. The points trigger the spark only. Normally the coil can't start to build up until the rotor cam comes around and closes the points. The makers claim the effective dwell period is longer than a four-lobe cam and dual

(Please turn to page 212)

How to Control Your Hi-Fi From Any Room in The House

You can turn your hi-fi system and remote stereo speakers on and off from any location. This low-voltage hookup makes the job easy and safe

By EUGENE WALTERS

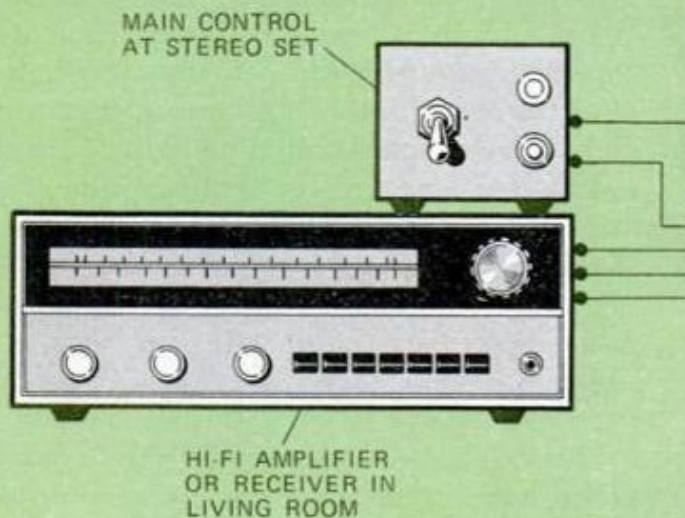
Photos by Robert D. Borst

YOU'RE IN THE BEDROOM dozing off contentedly to music from your stereo extension speakers when you suddenly realize you have to get up and go back out to the living room to turn off your hi-fi system before you fall asleep. Or maybe you've switched on extension speakers in a basement playroom only to discover when you get down there that the sound is too loud. So it's back upstairs again to fiddle with the volume control.

Today, most homes have at least one pair of remote speakers and many have two or more. It's a nuisance running back and forth from one room to another to turn the set on or off or change volume level. The simple remote-control system shown here ends all this. It not only lets you turn your hi-fi set on and off from any room in the house, but, as an added bonus, it also



Basic Remote-Control Setup



Technical Art by Jim Wright

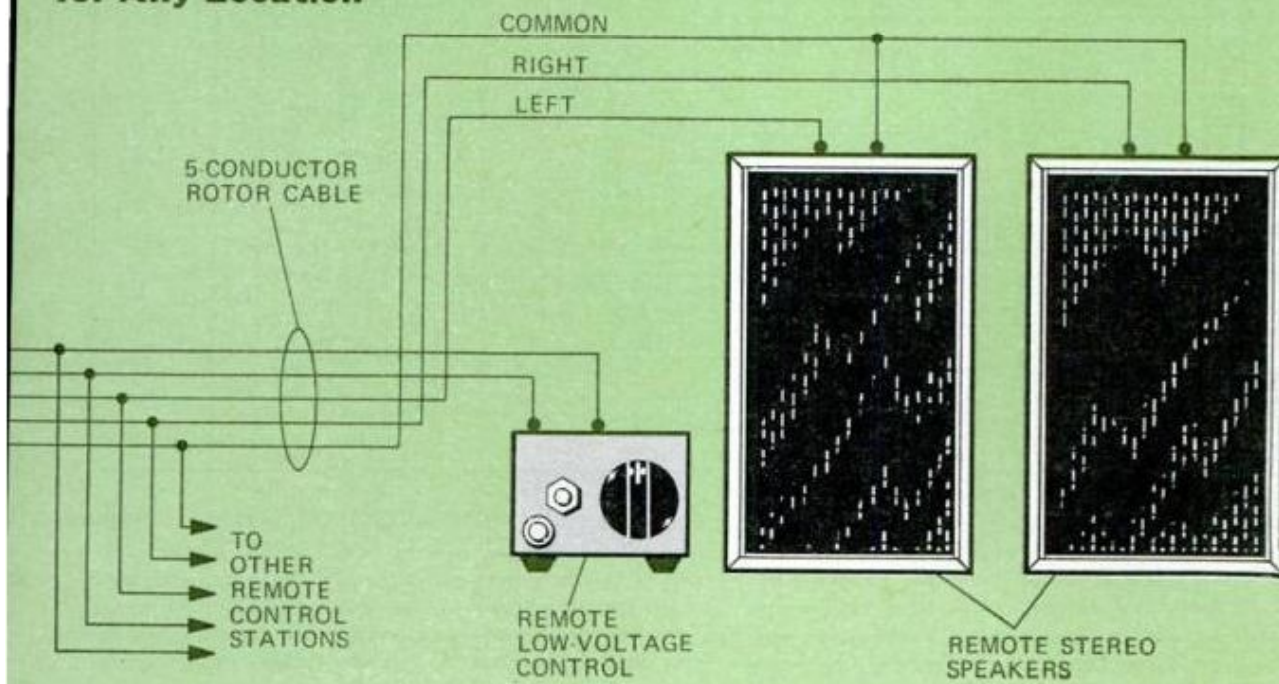
gives you independent control of your remote speakers.

The system is based on a low-voltage relay that controls power to your hi-fi set. You just plug your amplifier or receiver into an outlet on the back and the relay turns the power on or off. The relay is actuated by remote pushbutton switches—as many as you want anywhere in the house. The relay contacts are of the latching type that hold



CONTROL SYSTEM consists of two units—a main one at the hi-fi set (far left on opposite page) and a remote one at your extension speakers (near left). A low-voltage pushbutton switch in the remote unit activates a relay in the main unit that turns power to your hi-fi set on or off as desired. Relay is the latching type with contacts that open or close each time remote pushbutton is pressed. In addition, the remote unit contains a toggle switch for turning extension speakers on and off and a dual volume control for adjusting speaker level independently of the main hi-fi set. As shown in the diagram, any number of remote-control units can be connected to the main unit merely by running additional cables

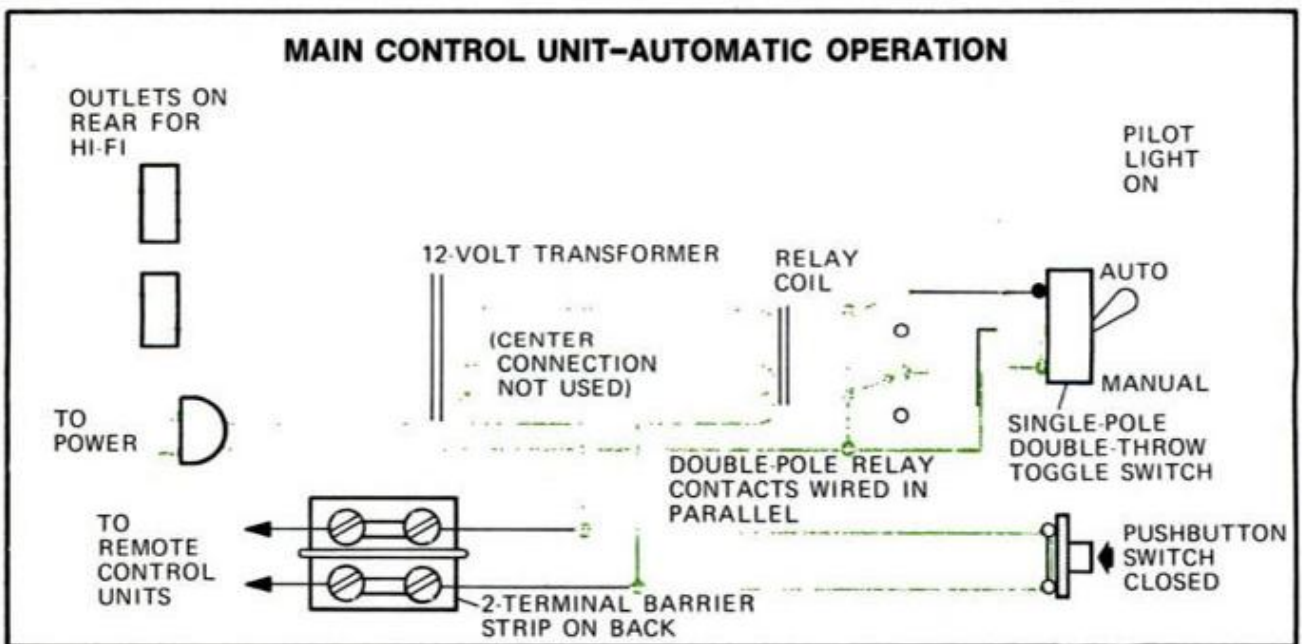
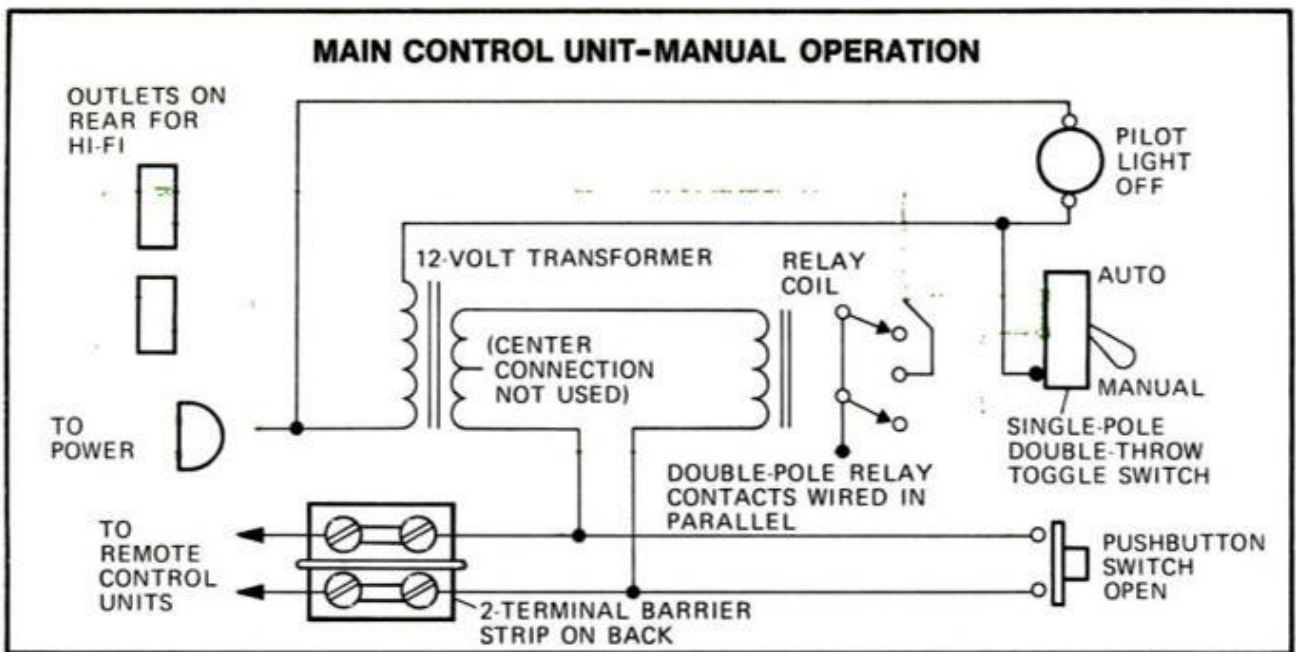
for Any Location



in either the "on" or "off" position without the relay coil having to remain energized. All it takes is a momentary pulse of current to trigger the relay. You press a button once and the contacts close, turning the set on. Press it again and the contacts open, turning the set off.

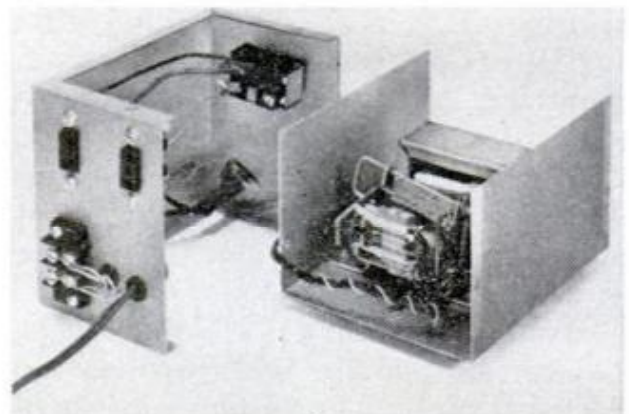
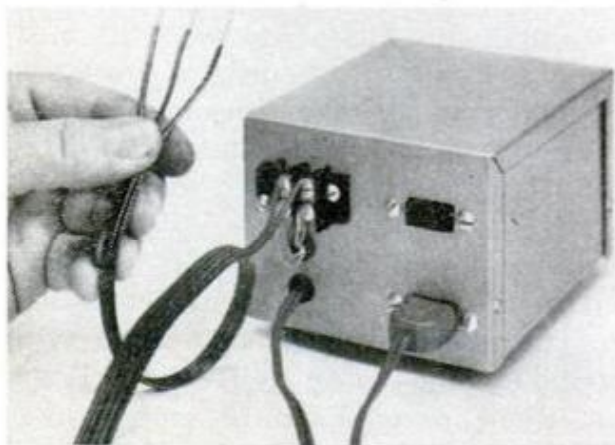
Because the wiring is all low-voltage, it's safe to handle and involves no electrical codes. The system consists of

two units—the main control at the hi-fi set and a remote control near your extension speakers. Any number of remote units can be connected to the main control. From each one you'll need a total of five wires—two for the pushbutton switch and three for connecting to the speaker output terminals on your hi-fi set (left, right and ground). One handy dodge here is to use five-conductor rotor cable—the



HOW MAIN CONTROL WORKS is shown in diagrams above. With toggle switch in manual position (top), power is fed directly to outlets on rear of the unit, and hi-fi is controlled at the set in the usual way. With switch in automatic position (bottom), power is fed to transformer and relay. Outlets are now

controlled by pushbutton switch on main unit or by any of the remote pushbuttons. Photo at left, below, shows how five-conductor TV cable provides two leads for remote-control pushbuttons and three for stereo extension speakers. Photo at right shows relay and low-voltage transformer inside main control

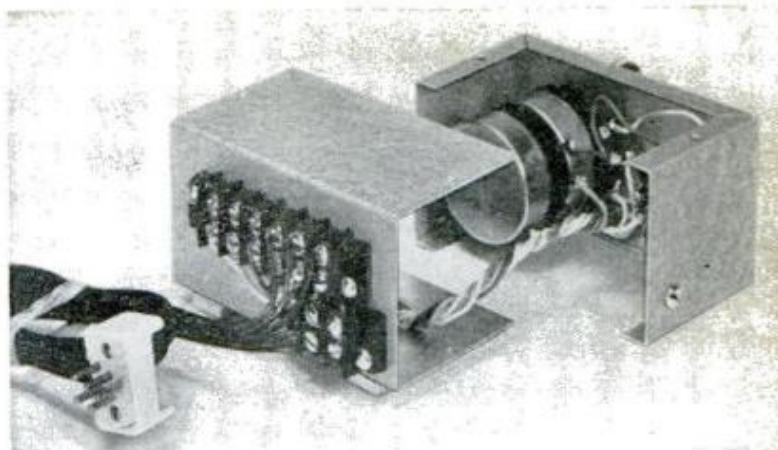


kind sold for controlling TV antenna rotators. This is readily available, inexpensive and easy to work with because it's thin and flat. A 100-foot roll costs about \$4 and can be purchased at stores that sell and install TV sets.

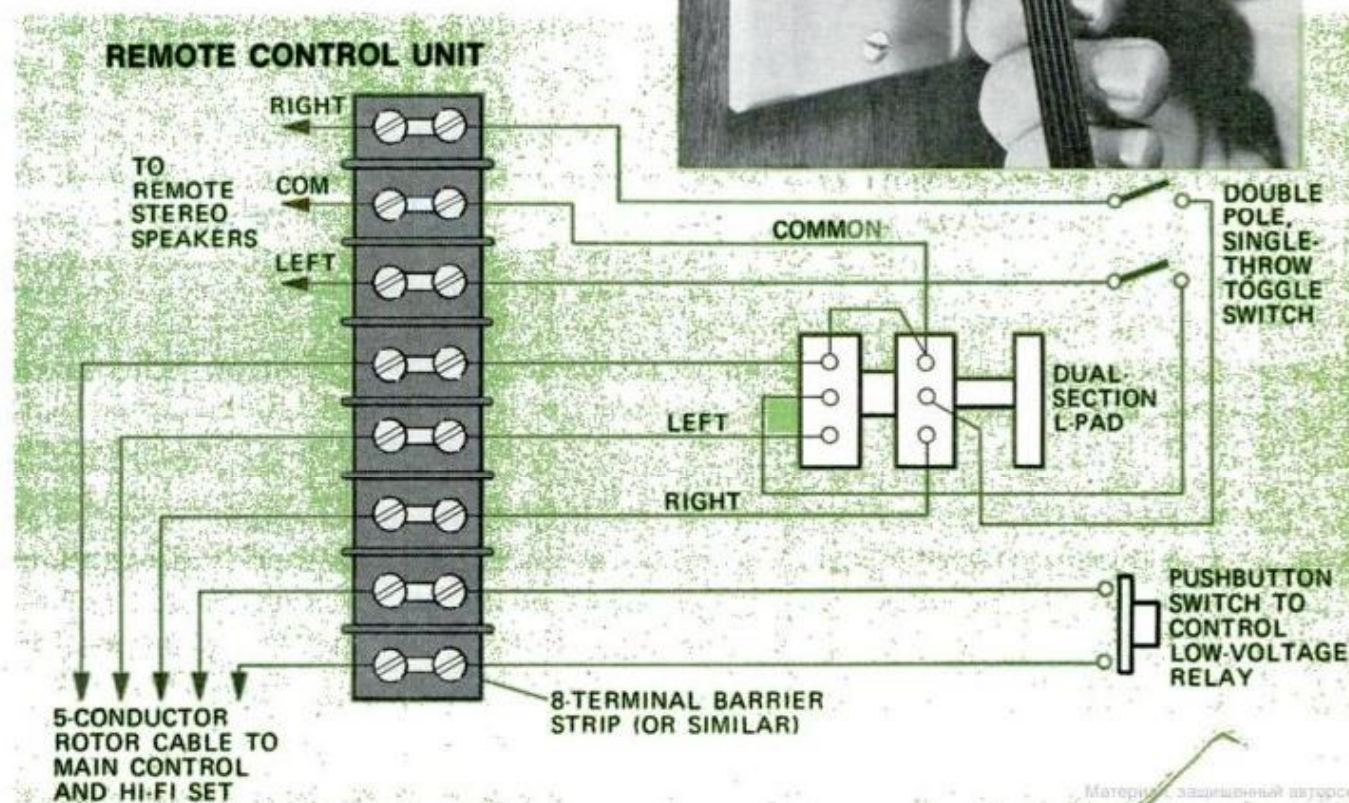
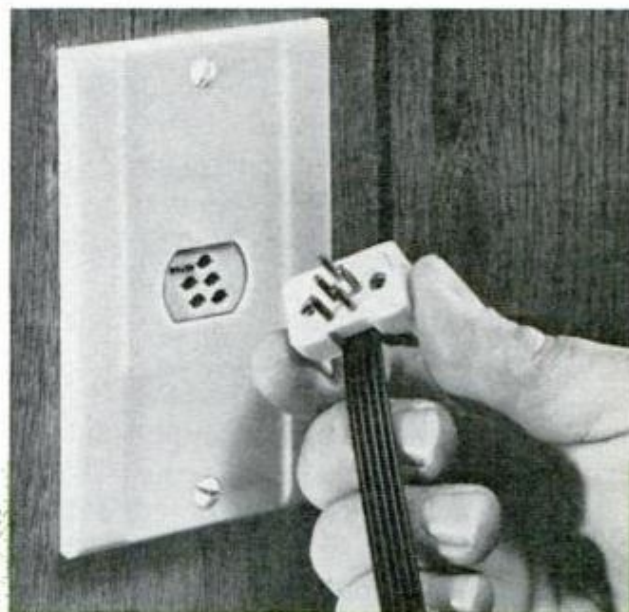
The low-voltage relay is installed in the main control unit along with a 12-volt transformer to power the relay coil. These parts fit in a 5x4x3-inch metal minibox or similar enclosure. Two outlets at the rear let you plug in your amplifier or receiver along with additional equipment, such as a phonograph or tape recorder.

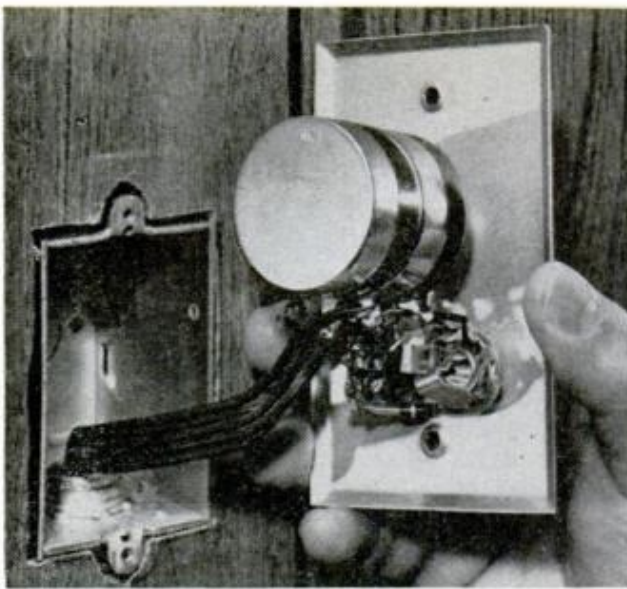
A single-pole, double-throw toggle switch gives you a choice of conventional manual operation or automatic remote operation. In the manual position, the outlets are constantly hot and your hi-fi is controlled from the set itself in the usual way. In the automatic position, power is fed to the transformer and relay, and the outlets are hot only when the relay contacts are closed. How this works is shown in the diagrams on the facing page.

In addition to the toggle switch, there's a 117-volt pilot light and a pushbutton switch that duplicates the remote pushbuttons. The pushbutton lets you operate your hi-fi set from the main control even when it's in the automatic mode. The pilot light goes on



PARTS FOR REMOTE CONTROL fit into minibox, as above, or can be mounted on a wall plate, as on the following pages. In either case, circuit is basically the same except that one shown here has screw-type terminals on the back for making connections. Note that five wires are needed to link each remote control with main control at your hi-fi set. For this, flat, five-conductor rotor cable is ideal and easy to use. You can snake the cable through walls and use standard five-pin wall-plate connectors made for TV installation, as shown in photo below. Diagram at bottom of page shows how dual L-pad volume control is wired through a toggle switch to terminals for connecting stereo extension speakers





OPTIONAL WALL-PLATE CONTROL makes a neat, inconspicuous installation, especially where you want a remote outlet for plugging in headphones. Fitting



into a standard wall box, it contains a dual L-pad volume control, stereo phone jack and a low-voltage pushbutton switch to turn hi-fi power on and off

only in the automatic mode to remind you that the system is energized.

The relay is a Potter & Brumfield type PC-11A with a 12-volt a.c. coil. If you have any difficulty obtaining this locally, it can be purchased by mail for \$8.25 postpaid from David National, Box 381, East Brunswick, N. J. 08816. This type of relay has two sets of contacts. While you really need only one, both sets are wired together in parallel. This doubles the relay's current-handling capacity and makes the contacts less likely to arc and pit.

The transformer is a 12.6-volt filament type rated at two amps. The one used here is a Calectro type D1-747. A similar transformer is Stancor's type P-8130 available from Lafayette Radio for about \$5 (catalog stock number 33F81191). These transformers have a center tap that is not used. Connect the two outer leads on the secondary side to the relay coil, wiring one lead through the pushbutton switch. The two leads on the primary side go to 117-volt house current through the toggle switch. Run the power cord out through a 1/4-inch rubber grommet in a hole at the rear.

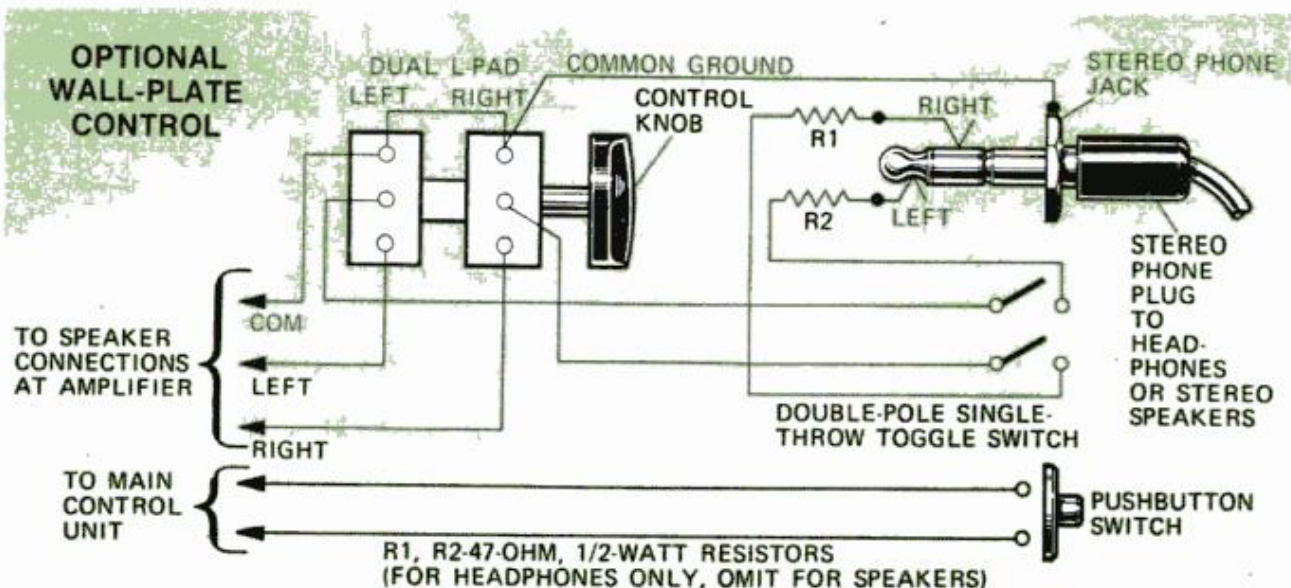
A two-terminal barrier strip, also on the back, provides connections for the remote-control pushbutton switches. Any type of normally open, momen-

tary pushbuttons can be used. For the 117-volt pilot light, get the neon type that has a built-in current-limiting resistor for long life.

The remote-control units can take several forms depending on your needs. Two versions are shown here—one designed for wall mounting and the other a small, self-contained control box. Along with the low-voltage pushbutton switch, both incorporate a dual 8-ohm L-pad volume control that simultaneously adjusts the sound level on two stereo extension speakers at once. The type used here is Calectro's S2-176. A similar control is available from Lafayette Radio (catalog stock No. 99F61400).

Wire the volume controls as shown in the diagrams. There are six terminals arranged in two sets of three each. The wall-mount version is designed to fit in a standard electrical outlet box and has a trim appearance. You'll need the extra-deep, 2 1/2-inch type of box, however, to give sufficient clearance for the long L-pad control. The parts mount on a blank metal wall plate available at hardware and electrical stores.

In addition to the volume control and pushbutton switch, there's also a phone jack in the plate for plugging in a pair of stereo headphones or extension speakers. Note that the diagram shows



WIRING DIAGRAM for wall-plate control shows how panel jack is connected through a double-pole, single-throw switch to L-pad volume control. Switch

allows you to cut jack out of the circuit when other speakers or headphones are in use. If only speakers are played, omit the resistors shown at R1 and R2

two resistors wired in series with the phone-jack terminals. These are to protect headphones from sudden overloading that might damage them. If you plan to connect only speakers to the control, the resistors can be eliminated.

In the other version, parts are mounted in a 4x2 $\frac{1}{4}$ x2 $\frac{1}{4}$ -inch minibox. Instead of having a phone jack on the front, screw-type terminals are provided at the rear for making connections. Both versions also include a double-pole, single-throw toggle switch. This lets you turn your extension speakers on and off at each remote location without having to go back to the living room every time. To avoid overloading your system, it's best not to have more than two sets of speakers operating at any one time.

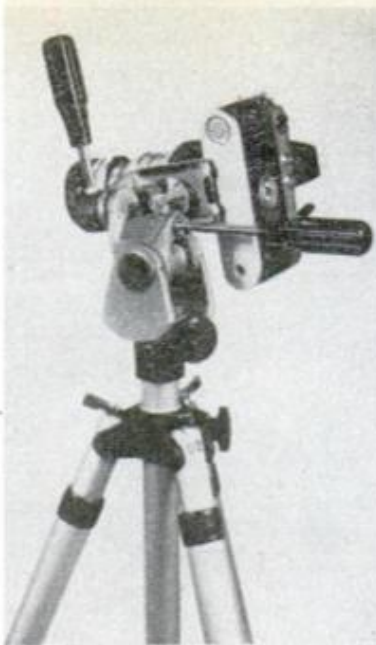
If you use five-conductor rotor cable for your hookups, you'll find that it's color-coded for easy identification of the leads. Four of the wires are copper-colored, while the fifth at one edge is silver. One simple system to follow is to start with the silver wire and make it the common speaker ground. The No. 2 wire then becomes the left speaker hot lead; No. 3, the right speaker hot lead; and the remaining two go to your remote-control pushbutton.

For a really neat wiring job, you can use the five-contact wall-plate connec-

tors made for plugging in a TV rotor control. These fit standard electrical outlet boxes or can be mounted in the wall without a box using special clips that come with the plate. This way, you can quickly unplug your remote control if you want to move it.

If you have remote speakers already connected and don't care about adding volume controls, you don't, of course, have to disturb your present wiring. In this case, all you need are two additional wires for each remote-control pushbutton switch.

In using your remote control, it's best not to stop a phonograph or tape player in the middle of a selection as this will leave the various drive rollers under pressure and can cause them to become distorted. However, if your machine has automatic shutoff after the last play, you can simply wait until you hear the music stop, then shut off the whole system with your remote control. Your radio can, of course, be turned on or off at any time without harm. Calectro parts are made by GC Electronics, Rockford, Ill. They are not available by mail, but can be obtained at, or ordered through, many local electronics stores. Lafayette parts can be purchased by mail from Lafayette Radio, 111 Jericho Turnpike, Syosset, N.Y. 11791. ★ ★ ★



Two Slick New Tripods:

There's hardly a camera angle you can't get with these versatile new tripods that turn and tilt in any direction. Shown above is Safe-Lock's tubular-leg model featuring easy-to-operate controls that enable you to adjust leg length from the top of the tripod. On the facing page is Quick-Set's square-leg design, also with a fast-adjusting arrangement. You just pull out the legs to the desired length and they lock in place automatically. Pressing a lever releases each leg so it slides freely. Both models have side-tilt adjustments that let you swing a horizontal-format camera on its side for vertical shots (center photo above for Safe-Lock's; far right on opposite page for

Quick-Set's). Both also have removable center columns that can be reversed for making low-angle shots with the camera mounted upside down below the tripod. An accessory side-mount arm can be fitted to Safe-Lock's column to hold a second camera or permit overhead copying work (left, above). The Safe-Lock PT-3 model extends to 82 inches, is \$49.95 from Welt/Safe-Lock, Inc., 2400 West 8th Lane, Hialeah, Fla. The side-mount bracket is \$8.25. The Quick-Set comes in a two-section telescoping model that extends to 55 inches for \$18 and a three-section version extending to 58½ inches for \$25.50. Available from Quick-Set, Inc., 8121 Central Park Ave., Skokie, Ill.

Spray system for color prints

The tricky and time-consuming process of developing color prints is speeded up by a simple three-step spray-on system developed by

British chemist Douglas Johnson of Aeroprint Products in Leicester, England. A color print is exposed conventionally, then sprayed with developer, fixer and bleach from three aerosol cans—all in less than 15 minutes.





Shoot High, Low or Sideways

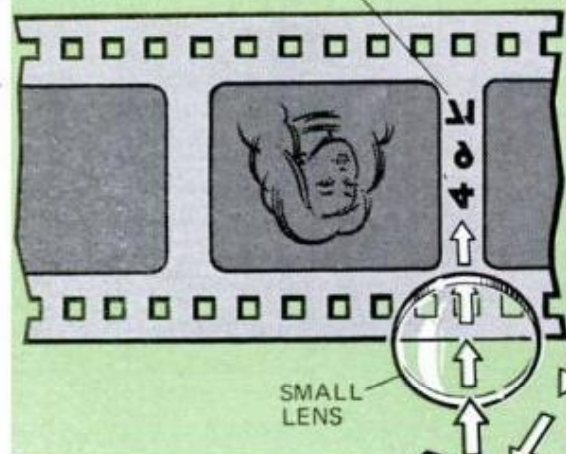
Camera with a memory dates your photos for you

Ever wish you could remember when a certain picture was taken, such as an important family event or exciting vacation experience? With this clever new 35-mm Canon, you can date your photos right in the camera at the time each picture is made. You set the day, month and year on numbered dials on the front on the camera. A tiny light bulb projects numbers onto the film through a lens and mirror arrangement so you have a permanent record of the date along the edge of each frame. Called Canodate E, the Bell & Howell camera is a rangefinder type with a 40-mm, f/2.8 lens and automatic electronic exposure control. About \$150.



NUMBERS, LIKE IMAGE, ARE RECORDED UPSIDE DOWN ON FILM, BUT APPEAR NORMAL ON PRINT

NUMBERS ARE ILLUMINATED IN REVERSE



SMALL LENS

MIRROR REFLECTS NUMBERS ONTO FILM

TINY LIGHT BULB

THUMB WHEELS DIAL DESIRED NUMBERS

YEAR

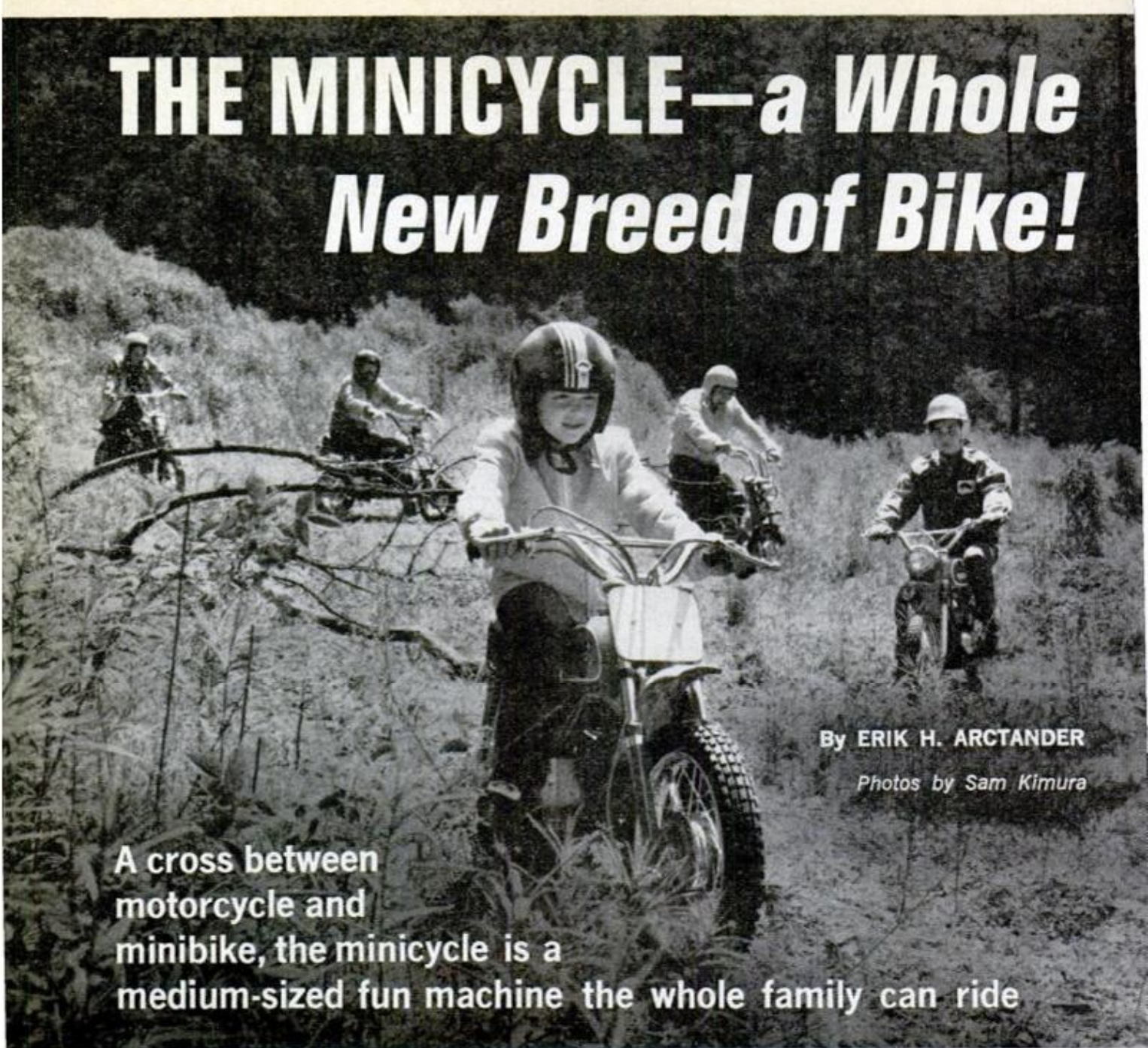
MONTH

DAY

DIALED NUMBERS SHOW UP IN WINDOW ON FACE OF CAMERA

Technical Art by Peter Trojan

THE MINICYCLE—a *Whole New Breed of Bike!*



A cross between motorcycle and minibike, the minicycle is a medium-sized fun machine the whole family can ride

By ERIK H. ARCTANDER

Photos by Sam Kimura

SHRINK A MOTORCYCLE until a 10-year-old or his dad can ride it and you've got a minicycle. Women can mount up, too, without feeling scared or silly.

What makes this new in-between machine such a fast-growing breed? The same enthusiasm that sparked a minibike boom by youngsters and a trail-bike rush by men. After trying a half-dozen minicycles, I'd say they're the best family-fun vehicle of the three. Here, for the first time, is a full-fledged motorcycle that's small enough for kids, yet big enough for grownups. My son Lance, who's 10, climbed right on and took off—he was riding confidently in a half hour. After 20 years on big and medium-sized bikes, I was surprised at how much fun it was zip-

ping around my back yard on one of these new midgets.

You can buy one minicycle for the whole family and share it. The kids can ride every day after school in the yard and you can take turns on weekends. When you go camping, slip one into the sedan trunk or the back of the wagon; no need for a carrier or special trailer.

If you go hog wild and outfit the family, four add up to the cost of one big road motorcycle, a deluxe snowmobile or a small outboard runabout. When *everyone's* mounted, you can go on long trips together off the beaten track. Most minicycles are actually miniature trail bikes and some even have quiet exhaust systems whose mufflers are U.S. Forestry



BRONCCO DIABLO



PREMIER BE BE



YAMAHA MINI-ENDURO



INDIAN BOBCAT



HONDA CT-70



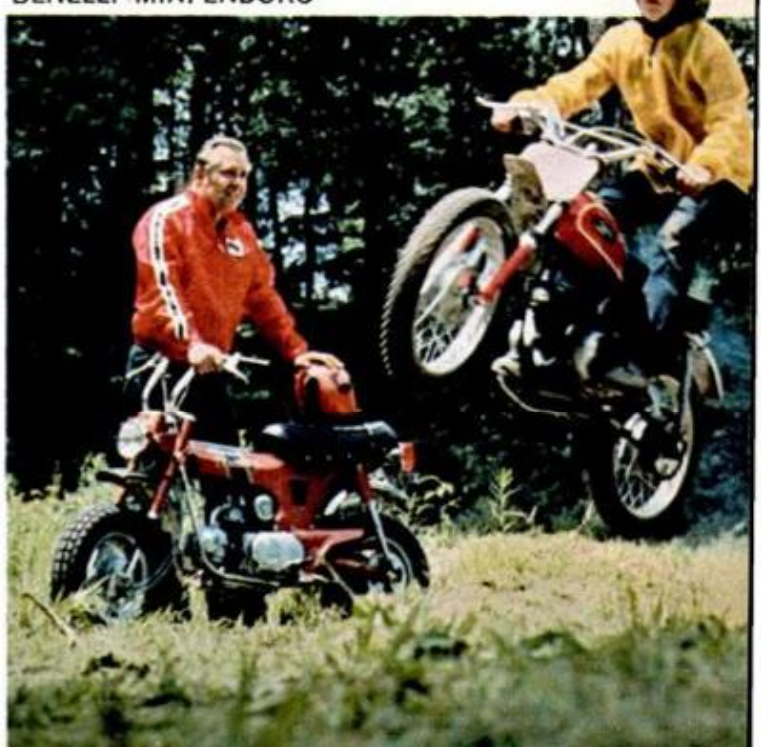
BENELLI MINI-ENDURO

NEW MINICYCLES have motorcycle engines, 10 to 16-inch wheels, heavy-duty shocks fore and aft, two-wheel brakes. Those pictured above are typical of the growing breed. They're sturdier, more reliable, and safer than most minibikes, yet lighter and more compact than regular motorcycles. With bigger wheels you can try some fancy acrobatics (right) without taking serious risks. It's best to stand on pegs for better balance, as this young jumper is doing

Service-approved. (Approval is stamped right into the muffler.)

Though headlights and taillights are common, don't think of minicycles as small road bikes. Many can be licensed and might do for local errands on suburban streets or rural roads. But the lights are actually to get a rider home safely if he's overtaken by darkness on the trail.

Other motorcycle features found on



COMPACT AND LIGHT, minicycles can be lifted into the back of a station wagon or the trunk of a car

some minicycles: electric horn, ignition kill button, speedometer/odometer, front fork lock, crankcase skid plate, tire pump and toolkit. The motorcycle features that make minicycles basically superior to minibikes, however, are larger wheels with thinner tires, heavy-duty shock absorbers and an engine designed for motorcycles.

There's no way to repeal the laws of physics: larger-diameter, thinner tires make a two-wheeler balance better at low speeds, climb in and out of holes and over obstacles more easily, plough through soft ground quicker and corner better at speed.

Any vehicle rides more comfortably with shocks than without them, of course. Fat tires and soft saddles may do the job on smooth pavement; they're not enough off the road. Even if the rider can take it, his machine can't. Bolts, air cleaners and chains begin to loosen and some drop off. Shocks improve handling, too, by keeping tires in contact with the ground.

Motorcyclismakers have been developing small-vehicle engines for many decades. The result is a compact, rugged powerplant that's built to take heavy loads at varying speeds. Such an engine is much more likely to perform reliably than one intended to propel a lawnmower at constant speed. The kick-starter, standard on minicycles, is not only much easier to use than a rewind pull starter, it stands up better in constant use.

What makes a minicycle more appealing to some than a full-sized motorcycle is its compactness. Preteens, girls, and even mothers who would shy away from a big machine seldom feel threatened by a



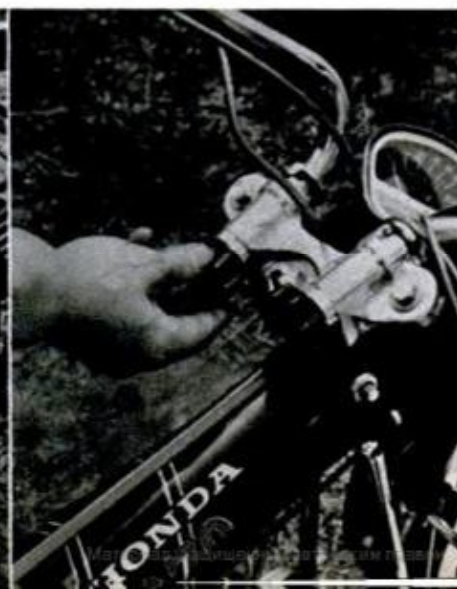
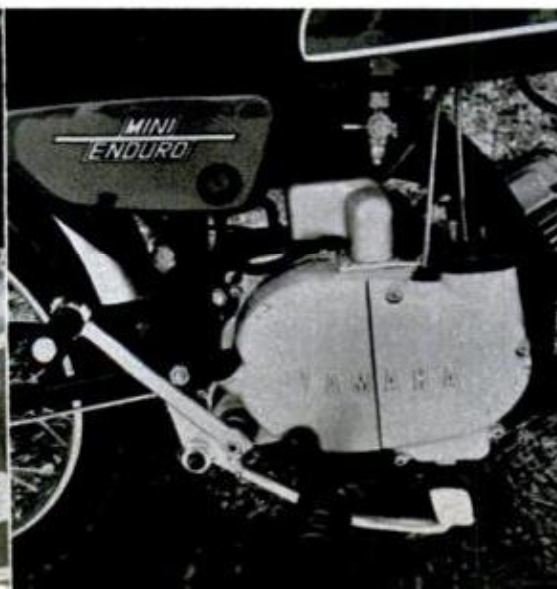
minicycle. They can put both feet down when they climb on, and begin riding slowly without running out of space. And, minicycles are easier to tote around because they're smaller and lighter.

Minicycles cost considerably less, too. Suggested retail prices, f.o.b. factory or port of entry, range from \$300 to \$500, with most clustered between \$300 and \$350. For delivered prices, add about \$50 for transportation and setup charges.

Inevitably, the half-dozen minicycles we borrowed turned out to have distinctive personalities. Premier was the half-pint of the bunch. Lance grabbed it immediately as a good machine to learn on. Broncco was most admired for its handsome, big-bike looks. Indian's powerful engine and high handlebars give it a racy, for-grown-ups look. The Benelli started easily and ran continuously without fuss.

Among the youngsters, Yamaha's Mini-

SPECIAL FEATURES abound on minicycles. Benelli (left) has a front fork lock, Yamaha (center) a separate oil tank for its two-stroke engine, Honda (right) handlebars you can fold down for easier carrying



HANDLEBARS and controls show influence of the motorcycle. Viewed from left to right are (top) Benelli, Broncco, Honda, (bottom) Indian, Premier, Yamaha. The ball-end clutch, front brake levers, ridged handlebar grips, cross-bracing are all safety measures. Machines in top row have speedometers and odometers. Except for the Yamaha, all models have headlights. In the Honda, the gas tank is under the seat; in the others, it's in front of seat. Folding footpegs are standard items on all six of these minicycles



Enduro was the big favorite. It lived up to its competition number plate by performing like a midget scrambler. Usually a first-kick starter, it had surprising zip and excellent handling because of large, 16-inch wheels and well-placed controls. I found the Mini-Enduro a bit tight on kneeroom, however, and grownups might find it uncomfortable on long rides. A separate oil-injection system made the Yamaha the only two-stroke that didn't need oil mixed with its gasoline.

My favorite was the Honda, which seems designed more for grownups than kids. It's the heaviest of the lot, which made the smaller youngsters avoid it. But the CT-70 has the only four-stroke, battery-ignition engine, the quietest exhaust note, plenty of kneeroom, folding handlebars and a fuel cutoff system that lets you lay the cycle on its side with a full tank of gas. Honda's latest minicycle, the SL-

70, has larger wheels and a more conventional frame; it should be well worth investigating.

Where should you look for minicycles? Motorcycle dealers are the best bet, though you'll also find them where minibikes are sold—sporting goods, hardware and nationwide department stores (Penny's auto centers sell Benelli, for example). Before choosing a machine, try to get a demonstration ride. At least have everyone in the family sit on it for size. Youngsters should be able to balance it upright at rest; grownups should have enough kneeroom.

Here are addresses of companies whose minicycles are listed in the chart below:

Benelli, Cosmopolitan Motors, Hatboro, Pa. 19040.
Bombardier, 8600 Decarie Blvd., Montreal, Que., Canada.
Broncco, Box 260, Cornwells Heights, Pa. 19020.
Coleman, 250 North St. Francis, Wichita, Kans. 67201.
Honda, 100 West Alondra Blvd., Gardena, Calif. 90247.
Indian, 1535 West Rosecrans Ave., Gardena, Calif. 90249.
Premier Motor Corp., Hasbrouck Heights, N.J. 07604.
Yamaha, Box 54540, Los Angeles, Calif. 90054. ★★

SPECIFICATIONS FOR A DOZEN LEADING MINICYCLES

Model	Engine Displ. (cc)	HP	Speeds	Length Overall (in.)	Height Overall (in.)	Handlebar Width (in.)	Ground Clearance (in.)	Saddle Height (in.)	Tire Size and Type (F. & R.)	Dry Weight (lbs.)
Benelli Mini-Enduro	60	5.2	4	61	34	25	7	26	2.25x14 U	112
Bombardier Bantam Cross	50	5.0	4	58	38	28	6	—	3.00x10 K	119
" Bantam Trail	50	5.0	4	56	38	28	6	—	3.00x10 U	122
Broncco Diablo	75	5.0	4	60	37	29	7	26	3.00x10 U	120
" Eagle	75	8.5	4	60	39	29	8	27	3.00x12 U	110
Coleman Sport 5.30	49	5.3	5	57	37	28	6	—	3.00x10 U	115
Honda CT-70	72	4.0	4	60	38	23	7	28	4.00x10 U	137
" SL-70	72	5.0	4	64	38	28	9	26	2.50x16 U ¹	138
Indian Bobcat	100	12.5	4	57	40	31	7	27	3.00x10 K ²	125
" SS 54	50	6.0	4	64	32	—	7	26	2.75x16 K ³	105
Premier Be Be	50	5.0	4	56	32	25	4	24	3.00x10 K	107
Yamaha Mini-Enduro	58	4.5	4	59	34	25	8	25	2.50x15 U	120

U—Universal tread K—Knobby tread ¹R 2.75x14 U ²R 4.00x10 U ³R 3.25x15 K



Behind Those

Data: Estelle Guralnick

Remodeling a house in the Boston area, architect Karlis Grinbergs created an easy-to-care-for home

By HARRY WICKS, Workshop Editor

WHEN KARLIS GRINBERGS set out to renovate and modernize his home he knew pretty well what he wanted to do. Like most homeowners, he and his wife desired more storage area, but unlike the average do-it-yourselfer, Mr. Grinbergs is an architect whose design background more than armed him for the challenge confronting him.

POPULAR MECHANICS



CLEAN, UNCLUTTERED LINES of the interior wall give the room an elegant look, yet function for maximum storage. Stereo, books, records and the like are behind doors (near right in photo at left). Photos above and below show open and closed views of pass-through between living-room area and kitchen



Handsome Walls—Storage Galore

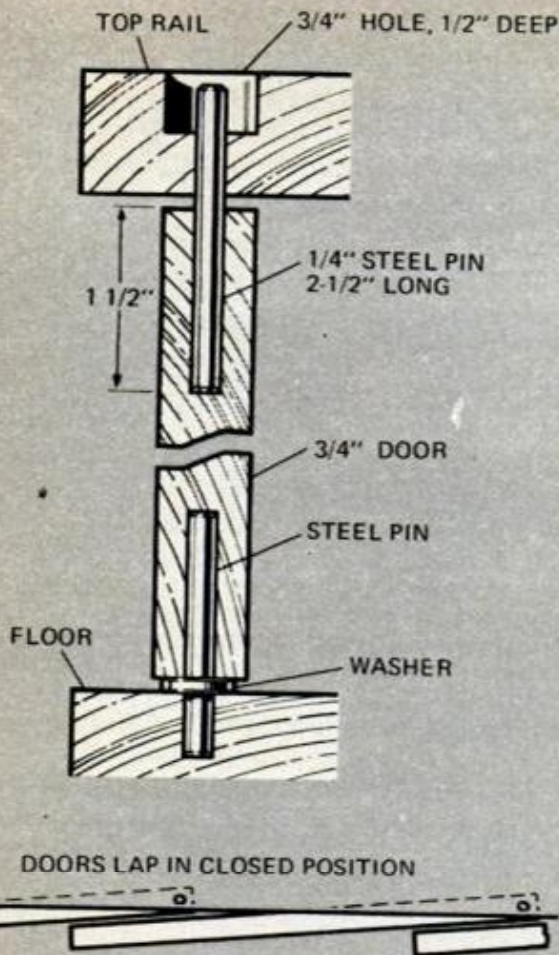
Photos by Robert Lofgren and Tony Linck

Starting with a carriage house in the Boston area, Karlis laid out, basically, three interior storage walls. Each is distinctive in that necessary hardware—hinges, pulls, catches and the like—are virtually invisible. The major storage wall, shown above, is between the living room and kitchen area. This and the other walls in this home are well-organized and pro-

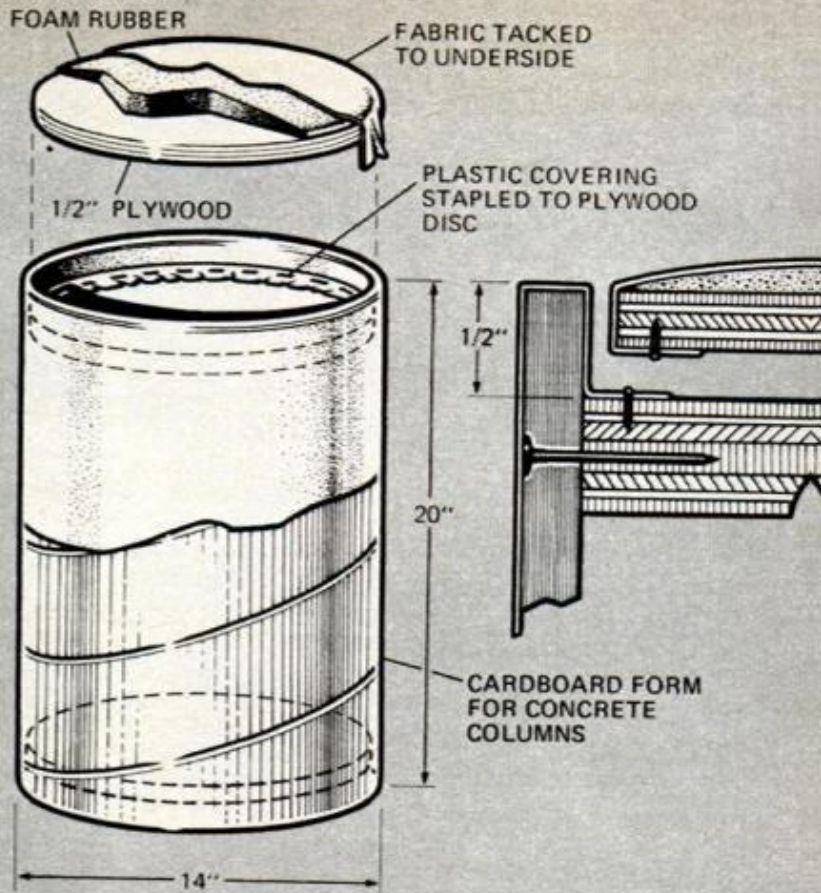
vide neat storage for all family possessions, including the youngsters' toys.

If you study the photos, you will note custom furnishings designed and built by the owner. The "stools" (see above right) typify Karlis's ingenuity. As can be seen in the drawings on the following pages, they are made by cutting down and covering cardboard forms used for pouring

PIN-HINGED DOORS



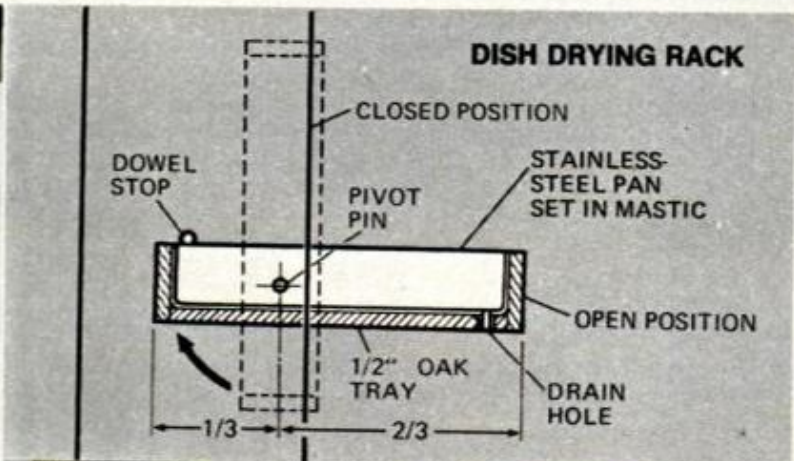
TUBE SEATS AND PLANTERS

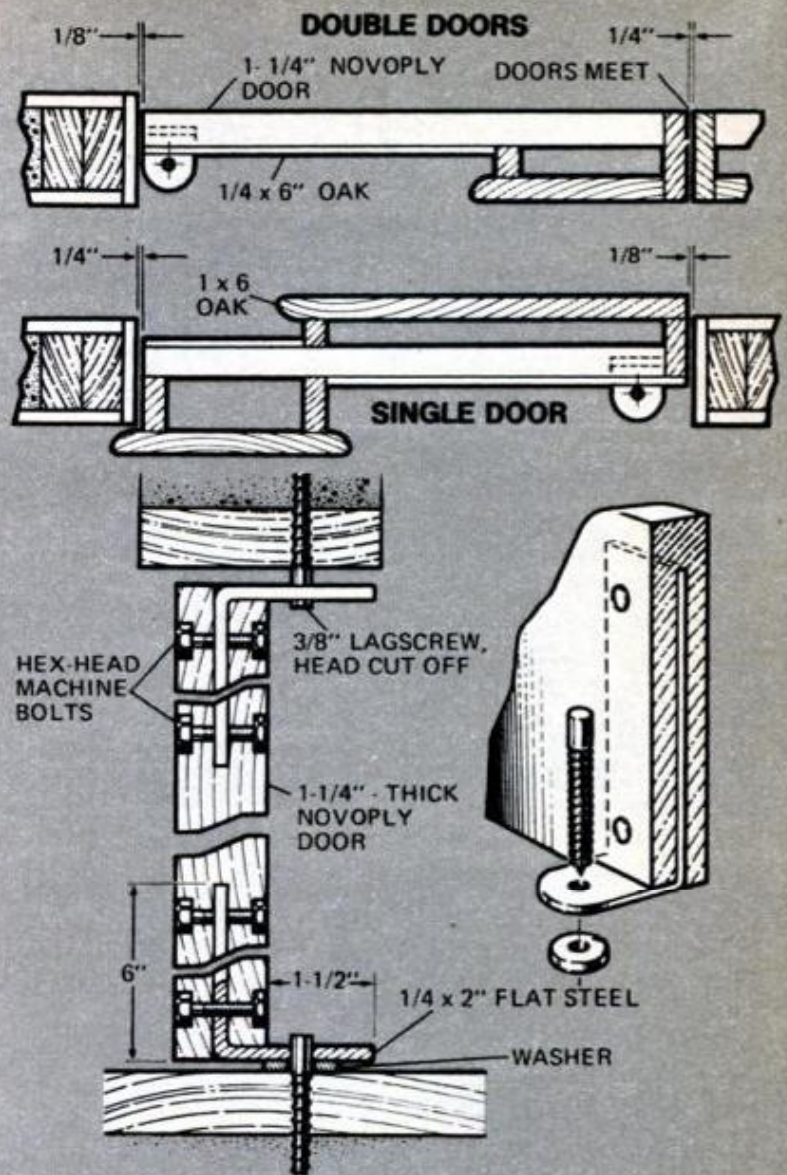
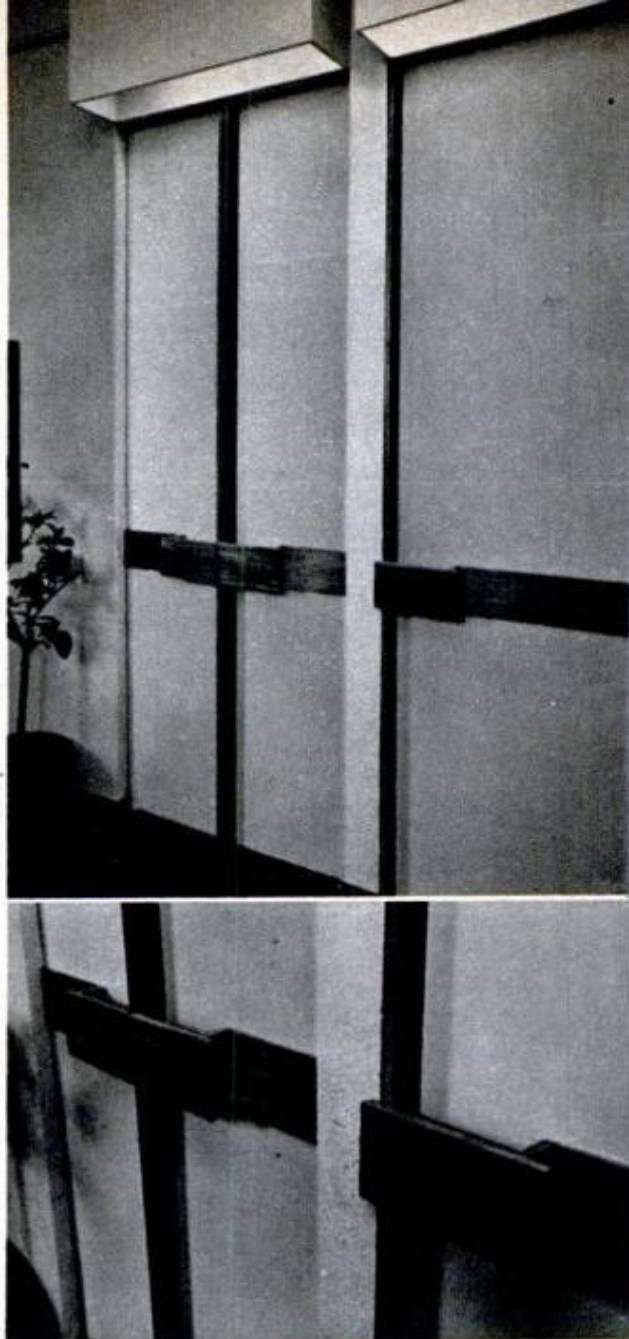


Technical Art by Peter Trojan

"HINGELESS DOORS" rotate on pins and washer-spacers in a unique system developed by the homeowner. Drum stools (above, right) and the planter shown on the preceding pages are actually cardboard tubing that is used in the formation of concrete piers. The finished product is handsome, yet it is inexpensive to build

CABINETS ABOVE AND BELOW SINK are also designed to be fully utilized. Even the doors, which are lined with a yellow floral vinyl, are fitted with shelves for glasses. A tilt-down drainboard (shown in drawing) is placed directly over the sink to provide a spot for glasses to drain. Drainboard is lined with stainless steel





CLOSET DOORS feature ingenious "hinging" and novel pulls (drawing at right gives details). Notice that angle is securely bolted to the door and that the pivot is actually a headless lagbolt. Light fixtures installed over the doors are simply boxes constructed of 3/4-in. plywood and used to conceal fluorescent tubes inside

concrete piers. The tubes are available at well-stocked building supply houses. (One brand name is Sonotube.)

Though not a cabinetmaker or carpenter, Grinbergs tackled the bulk of the remodeling work himself. He had to. Since he prefers invisible hardware, he got down to the nitty-gritty mechanical design stage as he came upon each individual challenge. Once his design ideas were worked out on paper and the kinks removed in prototypes, the rest was clear sailing. That's where you can start from; the details are shown in the drawings.

In addition to using bold, bright splashes of color carefully throughout the structure in combination with varying textures such as stone and paneling, the Grinbergs care-

fully selected their furnishings for total compatibility. The overall feeling of the house is that it is indeed lived in, yet lacks the clutter that plagues most active homes.

The house is full of ingenious space and labor-saving devices such as the storage wall featured in last month's *PM*, (*Ring-bound Storage Wall From a Kit*, page 94). For example, the kitchen cabinet shown on the facing page features a drainboard that flips up when not needed. The door "pulls" pictured above don't look like pulls but appear to be decorative architectural accents. Grinbergs' design ideas are unique, functional and add to overall room appearance. You might want some or all of them in your home. ★★★

DAN GURNEY

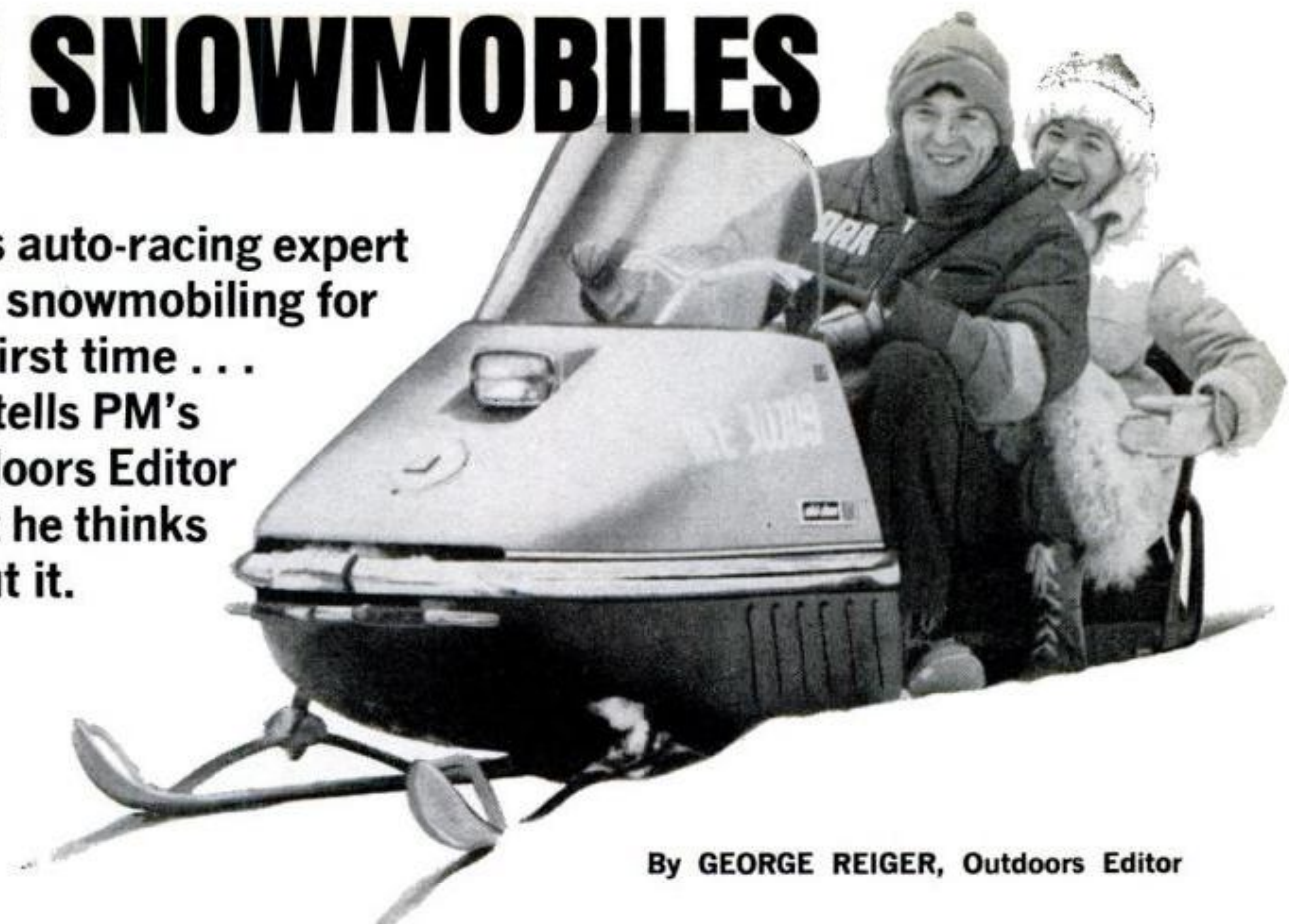
DAN AND EVI. The AAR on jacket is for All American Racers, which Dan founded



ENTIRE GURNEY FAMILY takes to snowmobiling. From left to right are Johnny, 15; Dan's mother, Roma; Lynn Dee, 13; Dan's dad, John, and Jimmy, 12. Dan, 10, was with me on my machine

ON SNOWMOBILES

PM's auto-racing expert tries snowmobiling for the first time . . . and tells PM's Outdoors Editor what he thinks about it.



By GEORGE REIGER, Outdoors Editor

VACATION FOR DAN GURNEY means being with his family. And I felt like an intruder when I drove into Greenville, Me., to find the Moosehead Lake home Dan had rented for a little leave time before the racing season began.

But no one's a stranger in the Gurney household, and within minutes, I was relaxing over a cup of coffee in the kitchen, discussing snowmobiles with Dan and his wife, Evi, while Dan's parents made sure their grandchildren had enough warm clothes for our outing that afternoon. Dan's enthusiasm for snowmobiling was so great I teased him that I'd tell PM's readers Dan Gurney can't stay away from fast machines—even on holidays.

Dan laughed. "Well, I've always loved motorcycles, and, in many ways, snowmobiles are similar."

"How so?"

"The way you use your weight to steer. And best of all, their versatility. The thing I most like about motorcycles is the freedom they give you to ride off the road, up into the hills or out across the desert. You get the same feeling with a snowmobile. You get to see places you couldn't ordinarily reach. The other evening, for instance, the family and I went down to the lake and had a cookout. The

temperature was about 10° F., and we had some eight-foot snowdrifts to cross. Usually you wouldn't think of picnicking under those conditions—but we had a ball!"

"What's your parents' reaction to all this? Weren't they a little leery of snowmobiling?"

"Only at first. Then the kids and I took them on a trip through the woods where we had previously broken a trail. Mom and Dad just couldn't believe how beautiful it was. They loved it!"

"Have you made any long trips?"

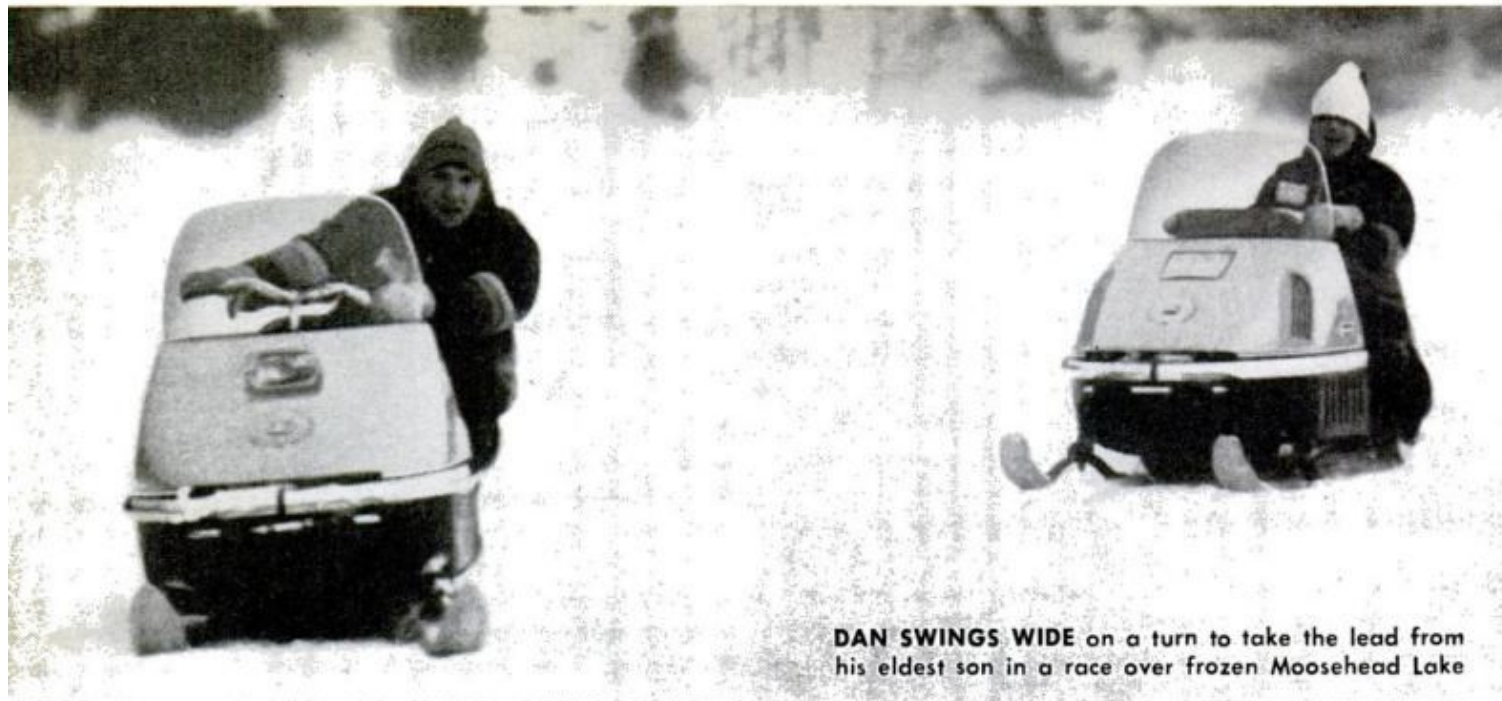
"Yes. My oldest boy and I have done quite a lot of trailbreaking. We explored every little place we could find, and got stuck a few times. But even that was fun!"

"Do you find snowmobiles safer than motorcycles? For instance, they don't run so fast and if and when you fall off, you bump into snow—not hard dirt or gravel."

"Safety depends entirely on the driver. If a man uses good judgment, no machine is any less safe than another. If you overdo anything—a motorcycle, car, a horse, for that matter—you're asking for trouble."

"Have you noticed any performance difference in the various machines you've used this year?"

"Yes. We have four different Ski-Doo models ranging from 292 to 399 cc. Our



DAN SWINGS WIDE on a turn to take the lead from his eldest son in a race over frozen Moosehead Lake



DAN REPLACES SNOWSHOE STRAP. Some state laws specify that you carry snowshoes out snowmobiling



small machines use a slide suspension system rather than bogey wheels, and they've really held up in heavy going. My personal favorite is the 335 Olympique without an electric start. It's a little lighter and has worked just fine."

"You get better flotation without the extra weight?"

"Exactly. The fewer accessories, the better. A good snowmobile is a little like a race car in that the higher the loading, the more you sink in. And it's important not to sink in too far."

"Are there any modifications you'd make in your equipment?"

"No, I've been very pleasantly surprised. Frankly, I expected to have trouble. I didn't know the first thing about snowmobiles when I got here, but the kids and I just climbed aboard and took off. Since then we've run through tankful after tankful of fuel without problems—and that's amazing to me. You wouldn't think little machines doing the work these do would hold up through day-after-day hard use."

"Do you think just any man without previous experience could climb on a snowmobile and learn to handle one by himself, or do you think your motorcycle experience helped here?"

"Well, I think any man can get on one, take off and have fun. But if you're talking about handling climbs, descents, turns

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JIMMY GLANCES OVER to see who's ahead in a race with sister, Lynn Dee, on a hill behind the house

POPULAR MECHANICS

Cold-Weather Tips For RV Owners



Whether you ski, hunt or snowmobile, your recreational vehicle can be your winter base camp—a warm one, too—if you make these few modifications. By V. LEE OERTLE

A FIRST STEP every owner should take to winterize his recreational vehicle is to disconnect his water tank, remove it if possible, and wrap it in inch-thick insulation. Urethane foam sheds no itchy fibers, and you can buy a 36x80-inch sheet (two pounds per cubic foot) from most upholstery shops for about \$2. Simply roll the tank into the foam, tape down the final fold, curl the corners and lap the ends. Two-inch-wide refrigeration tape or urethane adhesive (found in many upholstery shops) will hold the foam in place. Clip out the water pipe opening with scissors and reinstall the tank.

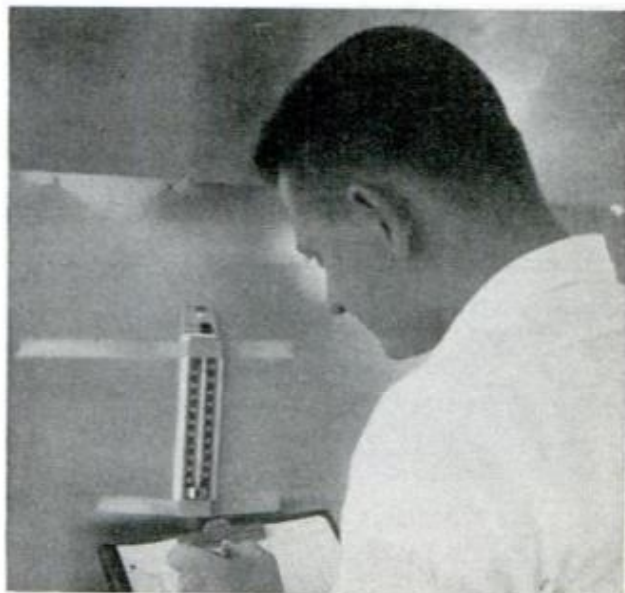
If your water tank *cannot* be removed without tearing out a wall, you can foam it in place. Buy a boat flotation kit. Park the coach in a warm, but ventilated, garage. Mix ingredients and pour them over the entire tank, including bottom. Thickness will end up a bit uneven, but that's no problem if you cover all of the tank. While a foam coating is harder to apply than an insulator blanket, it is a more effective cold-weather barrier.

The sanitary holding tank is more of a problem. Factories usually mount it under the coach in the rear of the frame. Plumbing and hold-down straps may be difficult to remove. Yet, most tanks are supremely vulnerable to freezing in that location. Once frozen, a tank cannot be drained. The flushing mechanism may also freeze, mak-

ing the entire system inoperative. For cold-weather camping, your holding tank will have to be insulated.

As one way to do this, a friend of mine towed his trailer to a local shop specializing in spraying foam insulation in boats. He had rigid urethane foam sprayed on his fiberglass holding tank. A four-inch-thick layer quickly solved his problem. If you can't find someone to do this, consider wrapping the tank with fiberglass blanket insulation and sealing the entire area with resin-soaked fiberglass cloth. A piece of

MOST COACH WALLS are from 1¼ to 2 inches thick. Greater thickness means better warmth in the winter





ONE DANGER OF WINTER CAMPING is a snow-blocked vent (above). Check all camper vents regularly before cooking, heating or going to bed, and keep the coach roof free of heavy accumulations of snow



CHECK ALL WINDOWS AND DOORS. This frame had been bent and the window would not close all the way. Result: cold drafts down my neck. Straighten faulty hinges and moldings; if necessary, replace them

Styrofoam or other stiff insulation material may also be used to protect your soft insulation from dirt and moisture and can be sealed in place with resin-soaked fiberglass tape. Remember, without some kind of protective covering, water and mud splashed up under your RV will cause a flexible foam blanket to sag away from the tank. If your tank is removable, apply steel packing-carton straps around the insulation to keep it in place. You can usually borrow or rent a hand tool for the job.

Use only trailer-brand antifreeze for your water lines. Never use automotive radiator antifreeze. And *never* put antifreeze in your drinking water! Follow directions on the package or can and carry spare cans to be used as you use the water.

Your water system may be pressurized, pumped electrically or a combination of both. Check the location of an electric water pump; you may have to insulate it. If ice crystals were to form around the impeller, it could slow down or jam, creating an overload that could burn out the entire mechanism. For a thorough job, wrap insulating tape around *all* water and sanitary plumbing inside the coach. This will take most of a day, but you'll rest easier on a cold night.

Insulation varies much from RV to RV. Some makers may install a five-inch-thick insulated floor; others simply tack down an inch-thick insulation board under the floor. If you have a cold floor, turning up the furnace gives you a hot, stuffy coach with little effect at floor level. You might beef up the floor with half-inch insulation board covered overall with a tough, all-weather carpet.

A simple way to handle the cold-floor problem in tent trailers and on other bare floors is to buy carpet remnants, cut them to fit, and install. Spray-on adhesive will keep them in place.

Sources of unnecessary heat loss are legion. A warped door, for example, will allow a lot of heat to escape. Cracked and weathered moldings should be replaced. You can tape heavy transparent plastic sheeting over window panes from the outside. New tapes with adhesive on *both* sides are good. When the weather warms up they can be removed cleanly—or with a little acetone.

Manufacturers should provide an airtight seal where pipe and wiring pass through the subfloor; some models have

gaps big enough to admit your finger! Check such openings and plug them. Rubber bushings can shrink or crack. A shock-absorber bushing cut in two can be inserted around pipes or wiring and taped in position as an effective way to block heat loss and drafts, also vermin such as ants and roaches. To block very small openings, use heavy refrigeration tape or apply a thick wad of black mastic with tape over the top.

Outside access points or bins may cause heat loss. I once owned a cheap travel trailer which seemed reasonably warm, except for the bed in the rear compartment. The mattress was five inches thick, yet we suffered every cold night. I finally located the trouble in an outside storage bin under one end of the bed. The bin door to the outside was not insulated and the door molding inadequate. I removed the aluminum door, applied a two-inch thick layer of urethane foam blanket and replaced the molding with a thicker, better-fitting one. Insulate all such doors on their interior surfaces.

Some ventilation is necessary if you intend to use propane lamps, a furnace or a range burner inside a closed coach. Leave a sidewall or roof vent cracked an inch or so. Some sidewall vents, however, allow more heat loss than necessary, and some kitchen exhaust fans and bathroom ceiling vents are vented through such openings, which may cause backdrafting. Seal them off in winter.

Heat escapes upward, an elemental fact overlooked by many engineers who should know better. Many early-model coaches were poorly insulated in the roof. To remedy this, you can apply roll aluminum over insulation board to create, in effect, a whole new top, which can be fastened with metal screws.

Tent trailers suffer most from heat loss through fabric tops, but even those with metal or fiberglass tops are often uninsulated. Though a layer of insulation applied underneath the top might help, fabric walls still allow heat to escape. For best protection during extremely cold weather, provide a double roof; that is, a separate cover like a large tarpaulin stretched over the entire trailer and tied down securely. There should be an air space between the top and the tarp. Keep frost and wind directly off the trailer top and you'll get a

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OCTOBER 1971



COLD FLOORS IN TENT TRAILERS can be cured with carpet remnants. Trim the carpet to fit snugly in all corners. Use two or three layers for added warmth



OUTSIDE BINS allow heat to escape. Insulate interior surfaces with foam or fiberglass and pack a quality sleeping bag for personal warmth on cold nights



USE ONLY PROPANE GAS or a propane blend for winter camping. Butane will not vaporize below 32°F. Also, insulate your gas regulator in some way

SNOWMOBILES IN '72

By **GEORGE REIGER**
Outdoors Editor



This year the emphasis is shifting from racing to quieter, safer machines

TWO HITS, ONE ERROR. That's our tally from last year's forecast of things to come. As predicted, Harley-Davidson and John Deere are now producing snowmobiles. Deere provides two models in its familiar green and yellow colors. The one

pictured above is a 436-cc, 36-hp machine running on a 15-inch track. Harley-Davidson has one red, white, blue and black model using a Harley 398-cc engine riding on an 18-inch track.

Our lone error was in suggesting that



**AMF
SKI-DADDLER**



**ARCTIC CAT
CHEETAH**

Model	Engine	Length (in.)	Track (in.)	Weight (lbs.)	Price
Mark IV 300	292-cc, 20-hp JLO L 295	96	15	330	\$ 795
Mark IV 400 D	399-cc, 28-hp Hirth	96	15	355	995
Mark V 400 E	399-cc, 28-hp Hirth	96	18	380	1070
Mark V 400 DE	399-cc, 28-hp Hirth	98.7	18	425	n.a.
Mark 500 DE	493-cc, 30-hp Hirth	98.7	18	425	n.a.
Mark V 640	634-cc, 40-hp Hirth	98.7	18	345	1395

Model	Engine	Length (in.)	Width (in.)	Track (in.)	Price
Lynx L-292	292-cc, 2-cycle Kawasaki	74	31	17	\$ 825
Puma PM-340	336-cc, 2-cycle Kawasaki	74	31	17	1100
Puma PM-399	398-cc, 2-cycle	74	31	17	1150
Puma PM-440	436-cc, 2-cycle	74	31	17	1200
Cheetah C-340	336-cc, 2-cycle Kawasaki	80½	31	17	1160
Cheetah C-399	398-cc, 2-cycle	80½	31	17	1210
Cheetah C-440	436-cc, 2-cycle	80½	31	17	1260
Panther P-303	303-cc Rotary Wankel	84	31	17	1250
Panther P-292	292-cc, 2-cycle Kawasaki	84	31	17	995
Panther P-340	336-cc, 2-cycle	84	31	17	1200
Panther P-399	398-cc, 2-cycle	84	31	17	1250
Panther P-440	436-cc, 2-cycle	84	31	17	1300

International Harvester might make the snowmobile scene in '72. It won't; there are no snowmobiles from IH in sight. The reason is recession—that same grim reaper of industry that's taken Starcraft and a dozen lesser manufacturers out of snowmobiling in the past 12 months.

Yet concentration of the field will probably make for better machines overall. Ski-Doo has purchased Moto-Ski, and Sears, Roebuck has announced it's introducing a line of machines manufactured by Polaris Industries. Larger, more strongly financed companies like these can better work toward eliminating some of the problems associated with increased use and abuse of snowmobiles. Bolens and Bombardier have announced they're giving up their factory racing teams to spend the money that would have gone to such promotion for research and development. Most important, they'll be working toward quieter, safer machines.

The '60s were a period of expansion—a time to get people acquainted with snowmobiles and the fun of snowmobiling. The challenge of the '70s lies in making the machines safer for those who use them and more acceptable for those who don't.

In some areas, this challenge has become a race against time. Canada, for instance, has imposed new standards for

snowmobile lights, brakes, shielding of moving parts and motor cutoff switches. Any manufacturer, foreign or domestic, who does not meet Canada's minimum safety requirements will be eliminated from that very important market.

The Canadians have also established maximum noise levels. For example, any racing machine rated at more than 82 decibels on the A Scale will not be permitted to compete in Canada. Most speed sleds still generate noise levels well above this maximum—and the Canadian government's deadline is only months away. The legislation will speed the departure of makers who can't redesign fast enough.

Meanwhile, there are some impressive refinements for the 1972 models. Most Johnson/Evinrude snowmobiles will feature a magneto-excited, breakerless (no points), capacitor-discharge ignition system first seen in their 50-hp outboard motors for '71. If this system does as well in snowmobiling as it's done in outboards, you can expect a significant reduction—and in some cases, elimination—of these common complaints: sparkplug fouling, piston scuffing and burning, breaker-point erosion, rubbing-block wear, erratic idle and insufficient alternator wattage for bright lights for night riding.

Scorpion features a "para-rail" suspen-

BOLENS SPRINT 440



Model	Engine	Length (in.)	Track (in.)	Weight (lbs.)	Price
83/293	292-cc, 18-hp	91	15	270	\$ 795
83/295	292-cc, 22-hp	103	15½	355	1045
83/340	336-cc, 24-hp	103	15½	355	1145
82/340	336-cc, 24-hp	103	15½	335	1195
83/433	433-cc, 40-hp	104	18	385	1275
83/440	433-cc, 40-hp	104	18		1415
84/440	433-cc, 40-hp	103	15½	335	1245

JOHNSON RAMPAGE 30



Model*	Engine	Length (in.)	Height (in.)	Track (lbs.)	Price
Challenger 27	437-cc, 27-hp	95	38.8	15.4	\$ 995
Challenger 21	399-cc, 21-hp	95	38.8	15.4	855
Light-Trac 25	437-cc, 25-hp	96	42	15.4	875
Johnson 32 with C.D.	437-cc, 32-hp	96	37.5	15.4	1145
Johnson 32	437-cc, 32-hp	96	37.5	15.4	985
Johnson 30	399-cc, 30-hp	95	38.8	15.4	1075
Skee-House	437-cc, 30-hp	103	41.4	20.5	1525
Wide-Trac 30 M	437-cc, 30-hp	103	47.4	20.5	1245
Wide-Trac 30 E	437-cc, 30-hp	103	47.4	20.5	1395

*Evinrude statistics are similar.

sion system. Polaris has hydraulic disc brakes; Suzuki, a dual-coil ignition system and a heavy-duty variable torque converter; Ski Whiz, extra heavy torsion springs. Mercury has a solid-state capacitor-discharge system; Sno-Pony, an easy adjust spring and bogey-wheel system.

Less in the way of new engineering than new design, Arctic Enterprises has introduced a miniature "Kitty Cat" snowmobile for youngsters or adults weighing less than 150 pounds. With a 75-pound rider, the Kitty Cat has a maximum speed of between 10 and 12 miles per hour, safe enough for most anyone. The machine weighs less than 100 pounds, fits in your car trunk and sells for \$250. Larkin Aircraft Corp. of Freedom, Calif., makes such mini-models for about \$300. So does Yard-Man, with a 4-hp, 125-lb. "SnoCub" for \$399.

If all our talk of "para-rails" and "bogey wheels" has confused you, we hope the information contained in the accompanying charts of different machines offered by leading snowmobile makers will help you. Despite lean times, snowmobiling is still the most rambunctious recreation industry; there are easily twice as many companies as we've listed. Shop around—and happy snowmobiling! ★ ★ ★



FRESH THINKING in snowmobile design is seen in Leisure Vehicles' Raider. Driver steers from cockpit seated over twin-track system; no leaning necessary



SEVERAL COMPANIES OFFER KITS for drivers who like to customize their machines. Shown is Alouette's Villain equipped with Ram Air Scoop and Nasa Ducts

SCORPION SUPER-STINGER II 440



Model	Engine	Length (in.)	Track (in.)	Weight (lbs.)	Price
Stingeroo 277	16-hp Sach Single	98	15	290	\$ 645
Stingerette 290	25-hp CCW Twin	104	15	316	1045
Super Stinger II 440	37.5-hp JLO Twin	104	15	386	1245
Stinger II 400	33-hp CCW Twin	104	15	358	1095
Stinger II 340	26-hp Sachs Single	104	15	325	895
Super Stinger III 440	37.5-hp JLO Twin	109	18	395	1295
Stinger III 400	33-hp CCW Twin	109	18	386	1195
Stinger I 293	19.5-hp Sachs Single	100	15	296	795
Stinger I 400	35-hp Sachs Twin	100	18	293	1145

POLARIS COLT



Model	Engine	Length (in.)	Track (in.)	Weight (lbs.)	Price
Colt 175 (1-cyl.)	175-cc, 12-hp	98	15	286	\$ 599.50
Colt 250	244-cc, 16-hp	98	15	300	729.50
Colt 295	294-cc, 21-hp	98	15	318	899.50
Colt 295 SS	294-cc, 23-hp	98	15	312	999.50
Charger 295	294-cc, 21-hp	104	15	390	999.50
Charger 400	398-cc, 30-hp	104	15	400	
Charger 530	530-cc, 36-hp	104	15	410	1399.50
Charger 400 SS	398-cc, 32-hp	104	15	385	1299.50
Charger 530 SS	530-cc, 38-hp	104	15	395	1499.50
Mustang 400	398-cc, 30-hp	108	20	453	1399.50
Mustang 530	530-cc, 36-hp	108	20	463	1599.50

SPECIFICATIONS FOR MORE LEADING 1972 SNOWMOBILES

Make and Model		Engine	Length (in.)	Height (in.)	Track (in.)	Weight (lbs.)	Price	
Alouette (All 2-cyl.)	Escort 295	Kohler 292-cc, 22-hp	94	n.a.	15	340	\$ 895	
	Venture 440	Kohler 436-cc, 30-hp	94	n.a.	15	385	1195	
	Eliminator 295	Sachs 291-cc, 24-hp	94	n.a.	15	340	995	
	Eliminator 340	Sachs 338-cc, 28-hp	94	n.a.	15	340	1095	
	Eliminator 440	Sachs 437-cc, 35-hp	94	n.a.	15	345	1195	
Ariens	275S	Sachs 277-cc Single	100	30	15	300	595	
	300S	Sachs 293-cc Single	100	30	15	325	650	
	350S	Kohler 338-cc Twin	100	30	15	345	n.a.	
	400L	Kohler 399-cc Twin	100	32	19	365	n.a.	
	400SS	Kohler 399-cc Twin	100	30	15	345	n.a.	
	350SX	Sachs 338-cc Twin	100	30	15	350	n.a.	
	450SX	Sachs 437-cc Twin	100	30	15	355	n.a.	
Boatel Grand Prix	GPS Mark II	398-cc, 30-hp	104	37	20	420	1186.50	
	GPS Mark III	436-cc, 36-hp	104	37	20	420	1256.50	
Chaparral	Skylark	250-cc, 19-hp to 292-cc, 21-hp	101	41	15½	297	725 795	
	Firebird 55	292-cc, 25-hp to 650-cc, 55-hp	101	36½	15½	320	999 1400	
	Firebird	340-cc, 30-hp to 440-cc, 36-hp	101	41	15½	329	999 1400	
	Thunderbird	340-cc, 30-hp to 650-cc, 55-hp	101	41	15½(18)	350	1050 1500	
	Mercury	Hurricane	644-cc, 35-hp	n.a.	n.a.	17	440*	1495*
Lightning		398-cc, 30-hp	n.a.	n.a.	15½	370	1245	
Rocket		339-cc, 25-hp	n.a.	n.a.	n.a.	n.a.	1130	
Poloron	Cyclone 704	295-cc, 20-hp	101	40	15½	300	695	
	Tornado 806	340-cc, 24-hp	101	40	15½	310	995	
	Tornado 804	399-cc, 28-hp	101	40	15½	320	1095	
	Tornado 805	399-cc, 28-hp	101	40	15½	350	1245	
Ski-Doo	Elan 250/250E	247-cc, 12-hp	88.5	40.5	15	252	595/695	
	Olympique 300	299-cc, 15-hp	100	43	15	327	725	
	Olympique 335/335E	335-cc, 20-hp	100	43	15	333	850/975	
	Olympique 399/399E	399-cc, 24-hp	100	43	15	349	975/1095	
	Skandic 335	335-cc, 20-hp	97.5	42	18	335	975	
	Nordic 440/440E	437-cc, 28-hp	101	46	18	405	1150/1275	
	Nordic 640ER	635-cc, 35-hp	101	46	18	474	1495	
	T'NT 295	292-cc, 20-hp	99	39	15	316	950	
	T'NT 340	340-cc, 28-hp	99	39	15	328	1095	
	T'NT 440	437-cc, 38-hp	99	39	15	356	1250	
	T'NT 640	635-cc, 40-hp	101	40	18	400	1450	
	T'NT 775	771-cc, 55-hp	101	40	18	440	1595	
	Alpine 640ER	635-cc, 35-hp	113	47	2x15	596	1750	
	Valmont 440R/440ER	437-cc, 28-hp	104	47	2x15	496	1325/1450	
	Skiroule	S Series S 250	293-cc, 18-hp	100	42	15¼	300	749
		SS 300	293-cc, 23-hp	100	40¼	15¼	300	829
S 340		339-cc, 24-hp	100	42	15¼	294	929	
S 400		398-cc, 28-hp	100	42	15¼	294	999	
SX 440		436-cc, 35-hp	100	40¼	15¼	305	1149	
R Series RS 440		436-cc, 35-hp	100	42	19	350	1099	
RT 500		436-cc, 35-hp	100	40¼	19	350	1249	
RT Series 300 E		293-cc, 18-hp	104	38	15¼	384	899	
340		338-cc, 26-hp	104	38	15¼	352	999	
440		436-cc, 35-hp	104	38	17½	384	1199	
440E		436-cc, 36-hp	104	38	17½	410	1299	
RTX Series RTX 300		293-cc, 25-hp	104	38	15¼	349	999	
RTX 440		436-cc, 40-hp	104	38	15¼	364	1199	
RTX 447		436-cc, 40-hp	104	38	17½	386	1299	
Ski Whiz		300S	JLO 292-cc, 18.5-hp	99.5	41	15.5	325	815
		350SS	JLO 336-cc, 22-hp	99.5	41	15.5	335	950
	400SST	JLO 340-cc, 24-hp	106	42	15.5	388	1145	
	500SST	JLO 399-cc, 28.3-hp	106	42	15.5	395	1195	
	Formula I racing	JLO 399-cc, 28.3-hp	99.5	41	15.5	n.a.	1045	
	Formula III racing	399-cc, 35-hp	99.5	41	15.5	n.a.	1125	
	Formula IV racing	440-cc, 37-hp	99.5	41	15.5	n.a.	1150	
Suzuki	360 Namad (2-cyl.)	359.3-cc, 28-hp	98.8	37.8	15	359	895 (965*)	
	XR-400 (2-cyl.)	395-cc, 35-hp	98	37.8	15	363	995	
Yamaha	SL 292B	292-cc, 20-hp	103¾	38	15	320	799	
	SC 338C	338-cc, 24-hp	103¾	38	15	348	899	
	SW 433B	433-cc, 30-hp	103¾	40¾	18	384	1095	
	EW 433B	433-cc, 30-hp	103¾	40¾	18	423	1195	
	GP 292	292-cc, 27-hp	103¾	38	15	320	899	
	GP 433	433-cc, 38-hp	103¾	38	15	357	1095	
	GP 643	643-cc, 43-hp	103¾	40¾	18	418	1375	

* Electric start n.a.—not available

How to Double The Life Of Your Tires

By MORT SCHULTZ



With proper care and maintenance, your tires can take you twice as far as you thought—you'll save money every mile!

A FREE SET of brand-new, top-line tires? Take care of your present tires and the extra mileage they will give may pay for the next set. It happened to me.

When I bought my new car in 1969, I was told the tires should last 20,000 miles. By maintaining correct air pressure, inspecting tires frequently and making minor repairs before they got worse, and rotating tires as called for by the manufacturer, I extended tire life to 40,000 miles.

My tires cost \$40 each. Instead of \$320 for two new sets of tires in 40,000 miles, I paid \$160 for one new set. I also saved \$21 by rotating tires myself (seven rotations in 40,000 miles at \$3 each) and more (hard to figure how much) by making some repairs myself.

Proper inflation is the most important service to give tires. It will extend tire life

and provide maximum safety. However, there's more to inflation than having a service station attendant check pressure when you fill the gas tank.

The Tire Industry Safety Council cautions you to check air pressure yourself, because you are never sure if the air pressure gauge at a service station is accurate. The Council offers a tire kit consisting of an accurate air pressure gauge, tread depth gauge, set of tire valve caps and a booklet on passenger-car tires for only \$1.50. Send a check or money order to "Tire Safety," Box 726, New York, N.Y. 10010.

If you own a recreational vehicle, the Council will send you a kit containing a special high-pressure metal air gauge, tread-depth gauge, set of metal valve caps and a booklet on RV tires. Send \$3.50

UNDERINFLATION causes excessive flexing of sidewalls, heat buildup and, at worst, damage like this

to "Recreation," Box 726, New York, N.Y. 10010.

Check pressure frequently to the inflation recommended by the manufacturer of your car. You'll find this in your owner's manual or you can ask a dealer who sells your make of car.

Do not go by the tire pressure printed on the sidewalls of your tires. This is the tire's maximum inflation at maximum load. Never exceed this pressure, but seldom should you have to use it.

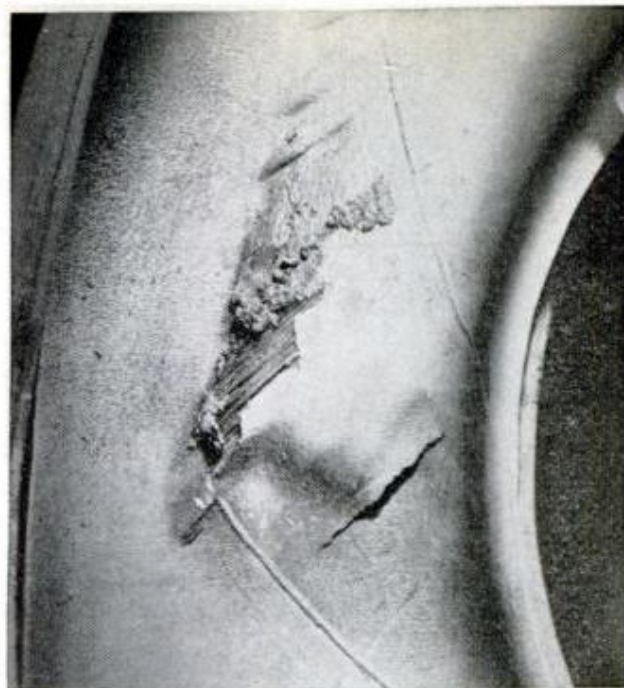
Check air pressure only when tires are cold, and never "bleed" (reduce pressure) tires when they are hot from driving. Pressure can increase six pounds or more above cold-pressure levels as you drive, but let it remain.

The only time to vary from normal inflation pressure recommended by a manufacturer is when you drive at turnpike speeds for long periods. Then, increase inflation pressure four pounds over that recommended by the manufacturer, but do not exceed the maximum pressure specified on the tire's sidewall.

Correct inflation provides the best traction and braking, easier steering, better cornering, and longer, safer tire life.

Rotation plays an important role in tire maintenance, but conflicting statements have led to confusion. Some manufacturers of front-end-alignment equipment argue against rotation. They contend that instead of rotating tires, alignment and wheel balance should be done frequently to prevent mechanical failure that causes rapid tread wear.

Naturally, alignment and wheel balance are important, especially when tread wear



or riding quality indicates a problem. However, car and tire manufacturers claim that tire life will be extended by rotating tires just to equalize normal wear. Furthermore, as a tire wears in its own peculiar way, it may start to make noise. Rotation will minimize noise.

There is yet another point. A car with perfect front-end alignment can have that alignment thrown out of whack in only a few miles of driving over bumps. To assure perfect alignment at all times would require a check more frequently than the once every 12,000 miles or so that most carmakers suggest, and front-end alignment service costs anywhere from \$12.50 to \$15.

You can save the \$3 or so it costs to have a mechanic rotate tires by doing it yourself. The spare goes to left front, left front to left rear, left rear to right front, right front to right rear and right rear into the trunk as a spare. If you don't include the spare, put the right rear on the left front.

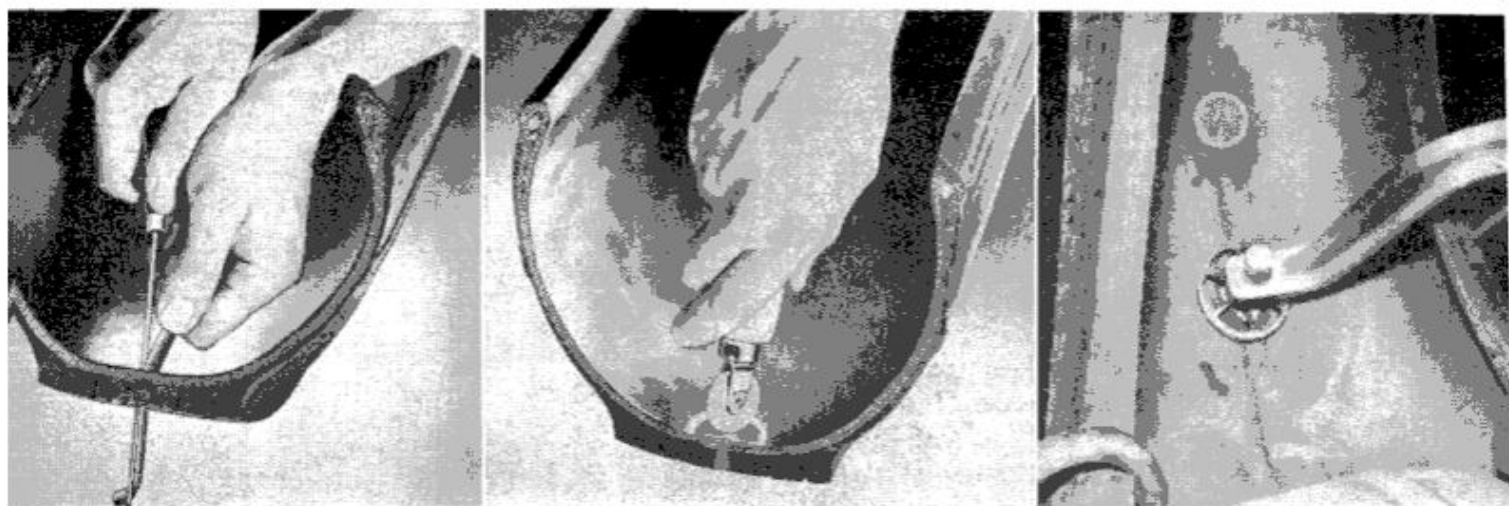
Every car manufacturer recommends tire rotation, but they differ. Pontiac and Buick suggest rotation every 6000 miles including the spare tire. Oldsmobile and Cadillac also suggest a 6000-mile rotation, but without utilizing the spare.

Pontiac says, "when rotating tires, do not neglect the spare since tires deteriorate through disuse."

Oldsmobile says, "It is not necessary to



AIR PRESSURE GAUGE alone is worth more than the \$1.50 for this kit; see text for address and details



PERMANENT TIRE REPAIR entails insertion of plug through the injury from inside the tire (left). With cold patch method (above, center), patch is placed over the plug and stitched down with stitching tool. Hot patch method (right) shows how patch is clamped into place over the plug and heat applied to make the bond

rotate the spare." Chevrolet says to rotate every 6000 miles, using or not using the spare.

Chrysler Corp. suggests that "under normal operating conditions," all tires should be rotated no later than every second oil change. You're supposed to change the oil in late-model Chrysler Corp. cars every three months or 4000 miles, whichever occurs first. Use or don't use the spare as you see fit, Chrysler says.

Ford recommends that you rotate its wheels and tires when tires begin to show an uneven wear pattern. The company says nothing about the spare.

American Motors suggests rotation every 8000 miles, with or without the spare.

If you have snow tires, they can be included in the rotation plan. It is a good idea to keep snow tires on their own rims—that is, not to take them off their rims when you store them for the summer. There is danger of damaging the bead when you break the tire away from the rim, which ruins the tire. Used rims in a junkyard will cost from \$5 to \$15, depending upon size and type.

Studded snow tires should always be used in their original positions. Never switch them. That would cause the studs to twist and loosen.

Every few thousand miles—at least at rotation time—inspect tires for stones and other objects sticking in the tread. Carefully remove them. If loss of air results, the tire should be removed from the rim, inspected for damage, and repaired. Examine each tire for unusual wear patterns. If your car is equipped with belted-bias

tires, they may be wearing in a way to cause you unnecessary concern. According to Pontiac, it is characteristic of a belted bias tire to show an apparent rapid wear of the second tread rows from the outer and inner shoulders. This condition is normal and doesn't decrease tread life.

A tire should be replaced if it's worn to a point where less than 2/32nds of an inch of tread design depth remains in any two adjacent tread grooves at three intervals spaced approximately 120° apart around the circumference of the tire.

Tread depth can be measured with a tread depth gauge which is marked off in 1/32-inch increments. In the absence of a depth gauge, insert the top edge of a penny into the groove. If the top of Lincoln's head shows, tread is worn and the tire should be replaced.

Every tire produced since July, 1968, has tread-wear indicators, which tell you at a glance if the tread is worn below the recommended depth.

Check tires frequently, but at least at rotation times, to make sure that there are no tread and sidewall cracks or cuts which extend into the cords. Look also for bulges and bumps. Incidentally, equip tire valves or extensions with valve caps to keep out dirt and moisture.

Do wheels and tires need balancing? When you rotate, have this work done if an unbalanced condition has been demonstrated by abnormal wear or a bad ride. Balancing should be for both static and dynamic conditions.

Static balance is the equal distribution of weight around the axis of rotation. Dy-

dynamic balance is the equal distribution of weight about the plane of rotation. Static unbalance causes a hop or bouncing action that is characterized by wheel tramp. Dynamic unbalance causes vibration (or shimmy), especially when the car is turning.

Tramp and vibration are different conditions. Tramp occurs usually at high speed and is caused by a wheel hop. In addition to unbalance, a loose linkage in the front end or bad shocks will lead to tramp. A car can have tramp in a front or rear wheel.

Wheel shimmy may occur at lower speeds and is a wobbly condition of the front wheels. In addition to unbalance, it can be caused by loose front-end linkage, loose steering gear parts or a faulty steering-gear adjustment. Shimmy occurs only in the front wheels.

Both tramp and vibration will be felt throughout the car. Vibration, however, will also be felt in the steering wheel.

Tire noise is another condition that may cause you concern. I'm not speaking of snow tires, of course. They produce noise, and you will have to live with it. With regular tires, however, noise can point up a problem. But first determine if the tires are really creating a noise by driving your



AEROSOL PUNCTURE SEALERS are fine in emergency; drive or spin wheel so sealer is distributed evenly

car at varying speeds. If the noise remains constant, tires are the cause. If noise varies pitch, it's being caused by something else, such as the axle or exhaust. Tire noise is generally more pronounced on smooth blacktop roads at speeds between 15 and 40 mph.

Tire noise is usually caused by under-inflation, incorrect front-wheel alignment, uneven tire wear or a defect.

Tire thump—that is, a “thump” with each revolution of the wheel—will be prominent only on smooth blacktop pavement which is free of surface irregularities. To find the thumping tire, inflate tires to a pressure of 50 pounds and drive on a blacktop road to notice how an increase in inflation decreases the thump. Now, drop pressure in one tire at a time and drive the car on the same road until the noise is again prominent.

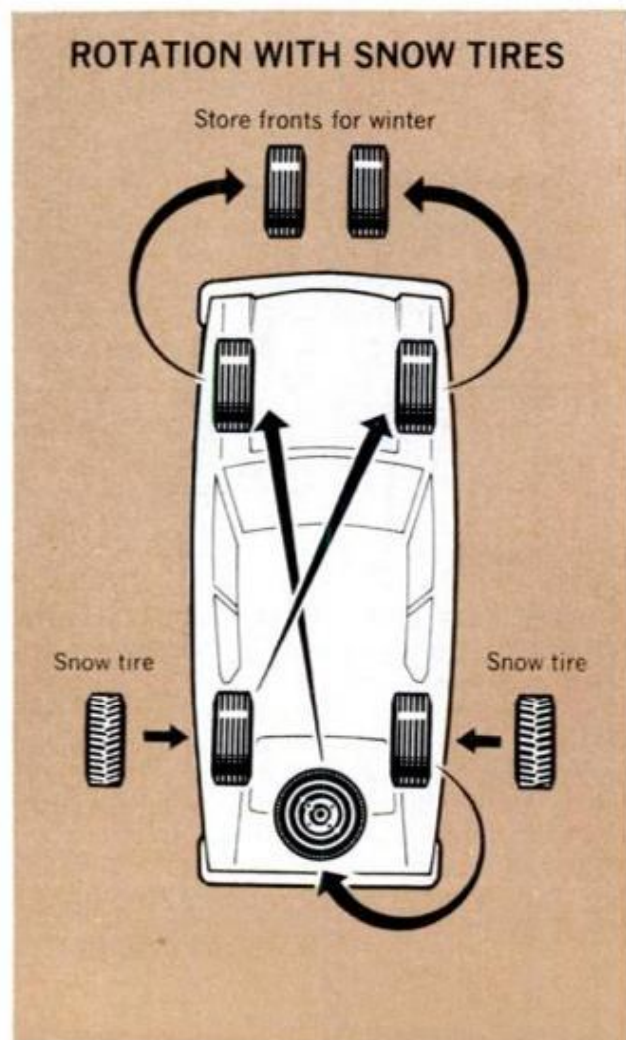
When you have found the thumping tire, check it for bulges, irregular wear and toe-and-heel (sawtooth) wear. Don't forget to return tires to normal pressure as quickly as possible. Striking a rock or other object lying in the road with tires at 50 pounds can cause the tire casing to rupture.

When a tire loses all or most of its air pressure, it should be removed from the wheel for a close inspection. However, before doing this, inflate the tire and apply soapy water to the valve. Check for air bubbles. In many cases, air loss is caused by a loose valve core and can be corrected by simply tightening it.

It doesn't pay for you to repair tires yourself. It's a tough job that is only made

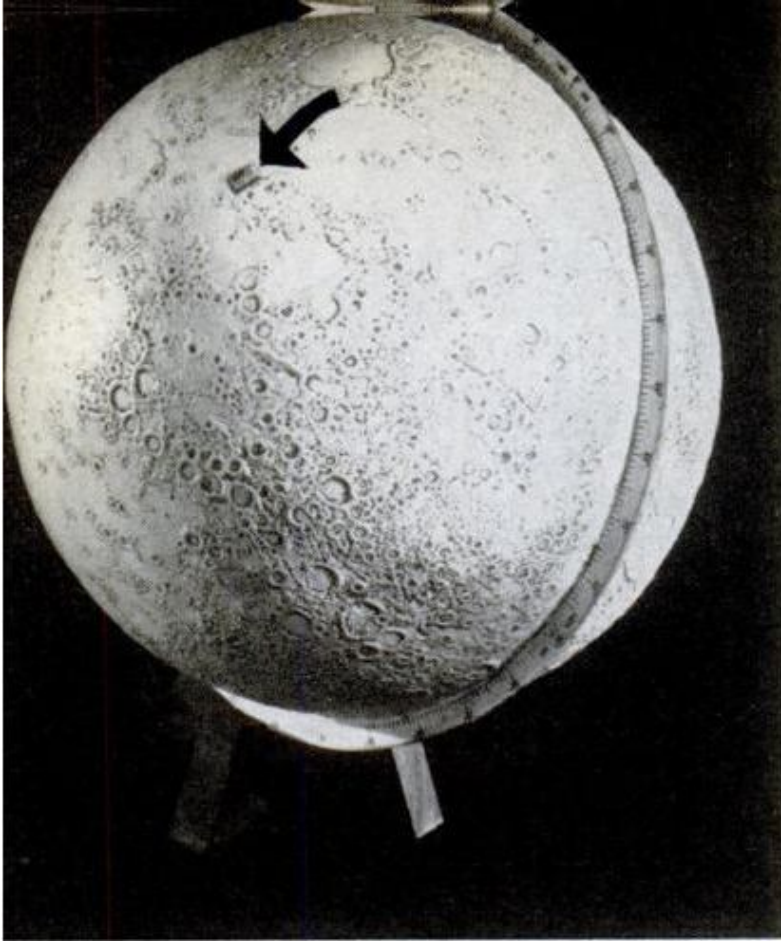
(Please turn to page 205)

ROTATION WITH SNOW TIRES

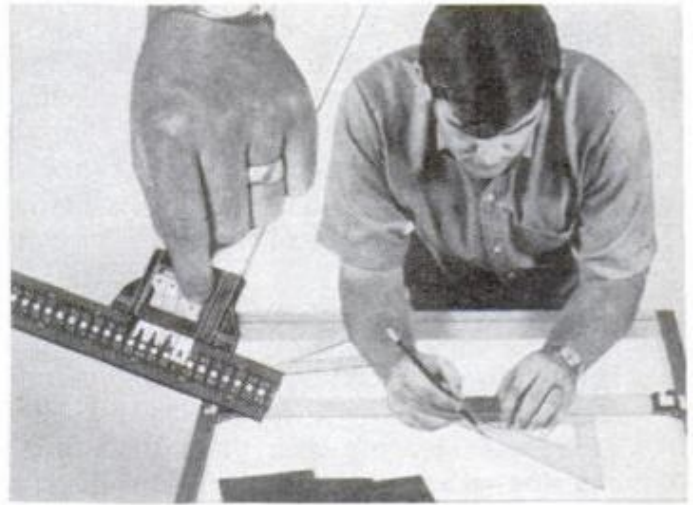


EXCITING NEW PRODUCTS

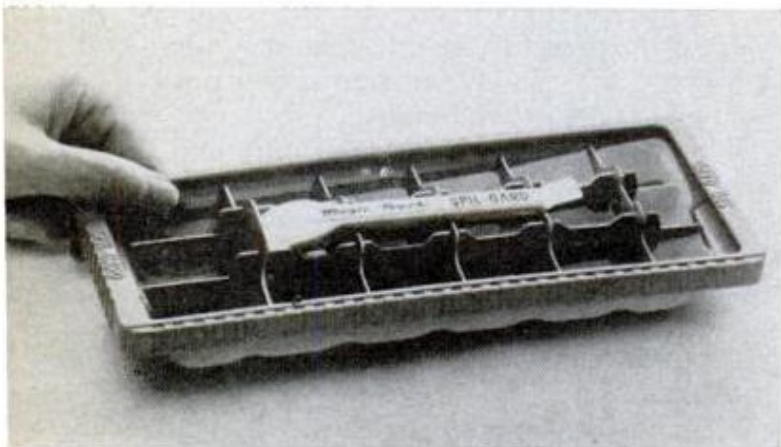
BY CATHERINE BILSKI



NOW YOU CAN TRACK LANDING ROUTES of past and future Apollo missions with the Mini-Moon. One side of the 12-inch washable plastic sphere shows the earth face of the moon; the American flag (arrow) denotes the Apollo 11 landing site. The model includes degree scales, which can be pasted around the libration area, and a cut-out quadrant. Sells for \$13.95 from Edmund Scientific Co., 380 Edscorp Building, Barrington, N.J. 08007.



MAKE ACCURATE SCALE DRAWINGS easily with the J-Rule Pushbutton Drawing System. Recommended for beginners and professionals, it features coded rules for scale drawing and locating parallel lines, ability to return exactly to any line for finishing, and a double lock that frees both hands. Comes with attachable items for many art tricks. Sells for \$28.75 from Jig Rule Products Co., Bowie, Tex. 76230.



PREVENT SPILLS AND SPLASHES while you carry a freshly filled ice-cube tray from the sink to the refrigerator by using a Spil-Gard ice tray; a specially designed lip all around the sides will trap the spills before they start. A flip of the ice tray's "Magic Touch" lever will free 18 cubes. Tray pan is made of tough Duralon. Price of \$3 is suggested by the maker: Inland Div., General Motors Corp., Box 1224, Dayton, Ohio 45401.

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A NEW CONCEPT IN MONOCULARS—the Wristscope—brings new convenience, performance, ease and protection to all users when distant targets need enlarging. Said to be as comfortable to wear as a watch, the Wristscope is always ready for instant use, yet both hands are always free. Ideal for hunting, boating, spectator sports, track and field and racing, it is priced at \$15.95. Ranging, Inc., Box 9106, Rochester, N.Y. 14625.

POPULAR MECHANICS



BRUSH ON AND WASH OFF! That's how easy it is to remove rust from cars, boats, tools, bikes or anything metal with Rust Eater. It's a jelly that works chemically on rust to remove it quickly and retard re-rusting. In kit form, the Rust Eater is combined with a brush (it's also available in an individual bottle). It retails at \$1.75 for the kit or \$1.39 individually from Turtle Wax, Inc., 1800 Clybourn Ave., Chicago, Ill. 60614.

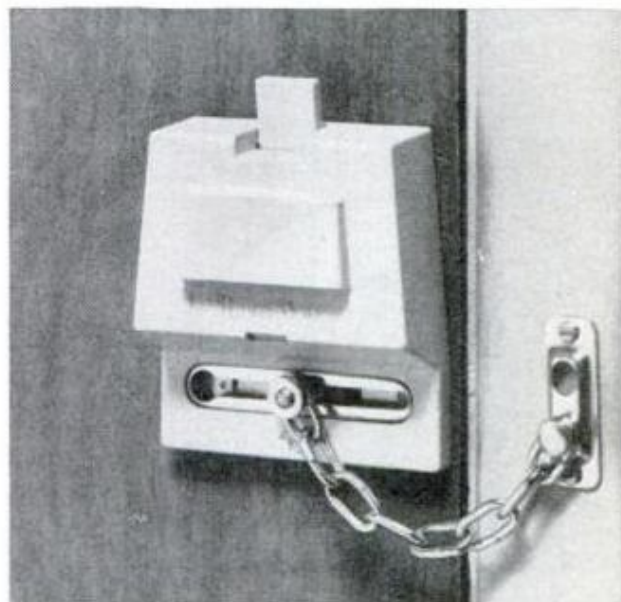


SURE TO BE A FAVORITE with campers and outdoorsmen, the Inflat-A-Tent is portable, waterproof, self-supporting and requires no poles, stakes or ropes. Its air-rib construction makes it stable and it inflates by mouth in seconds to provide instant shelter. When erected, it measures 7 feet long and 40 inches wide, and has a full floor. Folds into pack or pocket; \$9.95 postpaid from Illi Enterprises, Box 2123, Ann Arbor, Mich. 48106.



VERSATILE FLUID ABRASIVE known as Clover Compound is made up of thousands of diamond-like crystals (grains of silicone carbide) mixed in a heat-resistant lubricant for use in many sharpening, cleaning and polishing applications. Upon application, the lubricant leaves a corrosion-resistant film which may be removed with solvent. It lists at \$1 and is made by the Clover Manufacturing Co., Box 2280, Norwalk, Conn. 06856.

OCTOBER 1971



SAFEGUARD YOUR FAMILY, your possessions and property with the Chain Guard Alarm, which attaches to any door or window. Providing triple security, it frightens intruders by sounding a piercing alarm, gives advance warning that a door or window has been opened, and furnishes the personal protection of a safety chain. Operating on a flashlight battery, it retails for \$6.95. Slaymaker Lock Co., Lancaster, Pa. 17604.

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Two Quickie Workshop

Card-Table Drink Caddy

Between cards, chips and ashtrays, there's not much room left on the average card table for a drink or two. That's where this clamp-on drink caddy comes in handy. Attached to opposite corners, two caddies will hold four drinks, (plus refills) and two ashtrays.

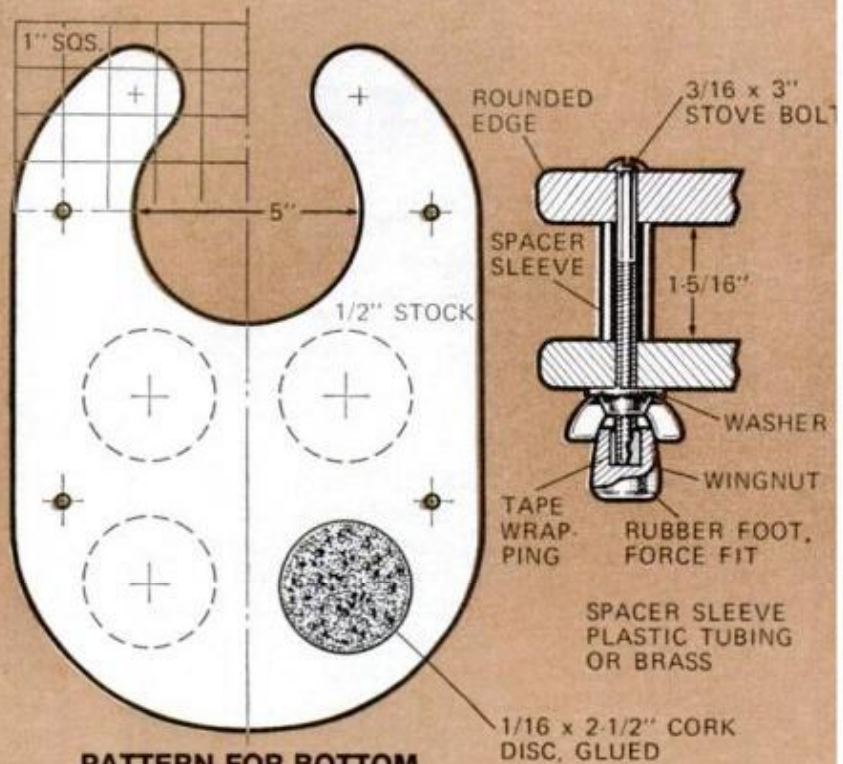
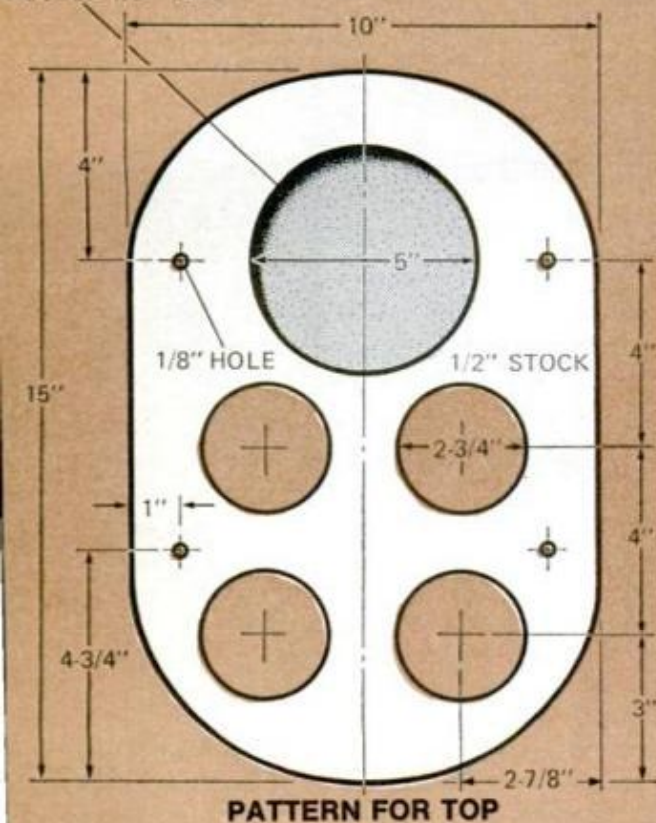
The caddies can pinch-hit as regular serving trays, when clamping bolts are fitted with rubber feet so they won't mar polished surfaces.

Each caddy consists of a top and a bottom—the top bored with a hole cutter for four glasses and recessed for an ashtray; the bottom cut out to clear the card-table leg. The four spacer sleeves are lengths of plastic tubing and are cut to suit the thickness of the particular card-table top. Cork discs are glued to the bottom board and felt is glued in the recess. Wingnuts clamp caddies in place.—*Harry E. Turloff, Port Huron, Mich.*



UNDERSIDE VIEW (left) shows cutout that clears table leg, rubber feet to keep bolts from marring

FELT COVERED
RECESS 1/8" DEEP

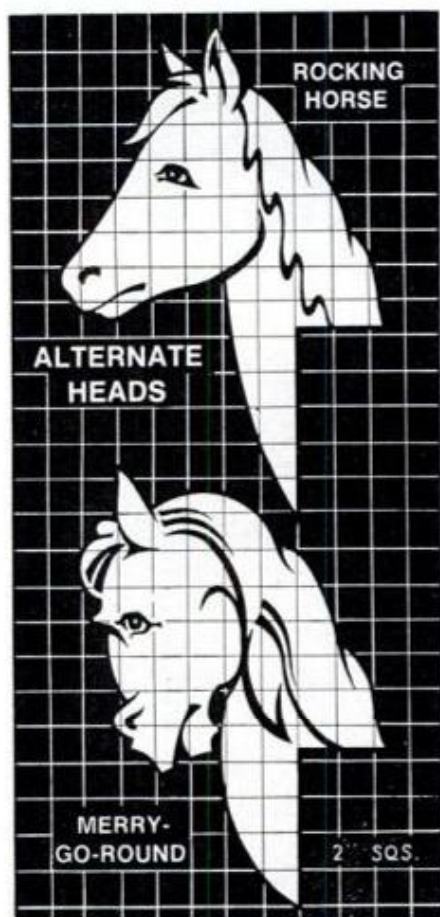
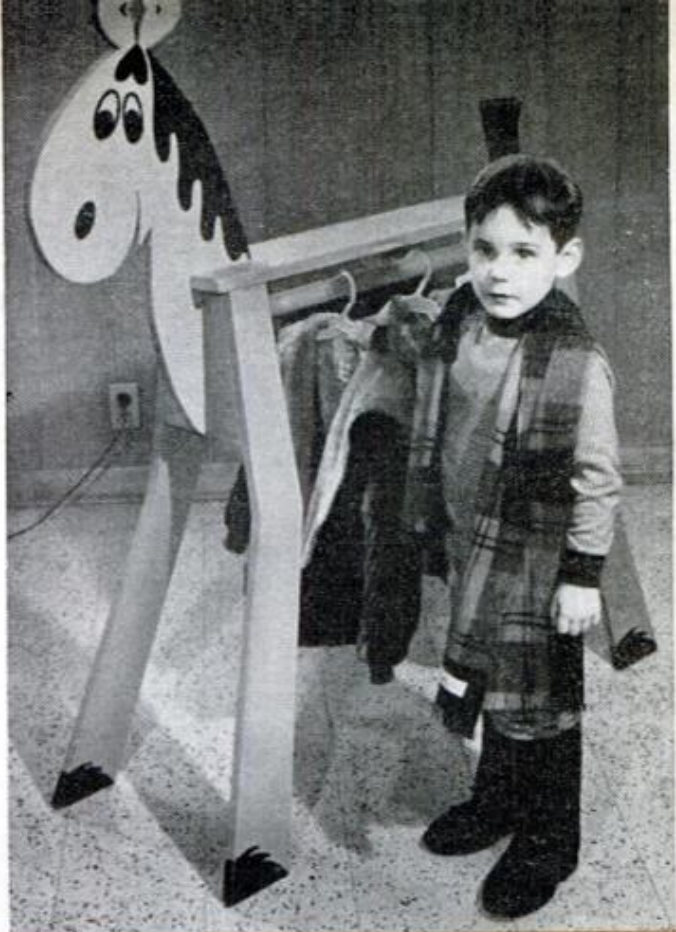


Projects

Child's Clotheshorse

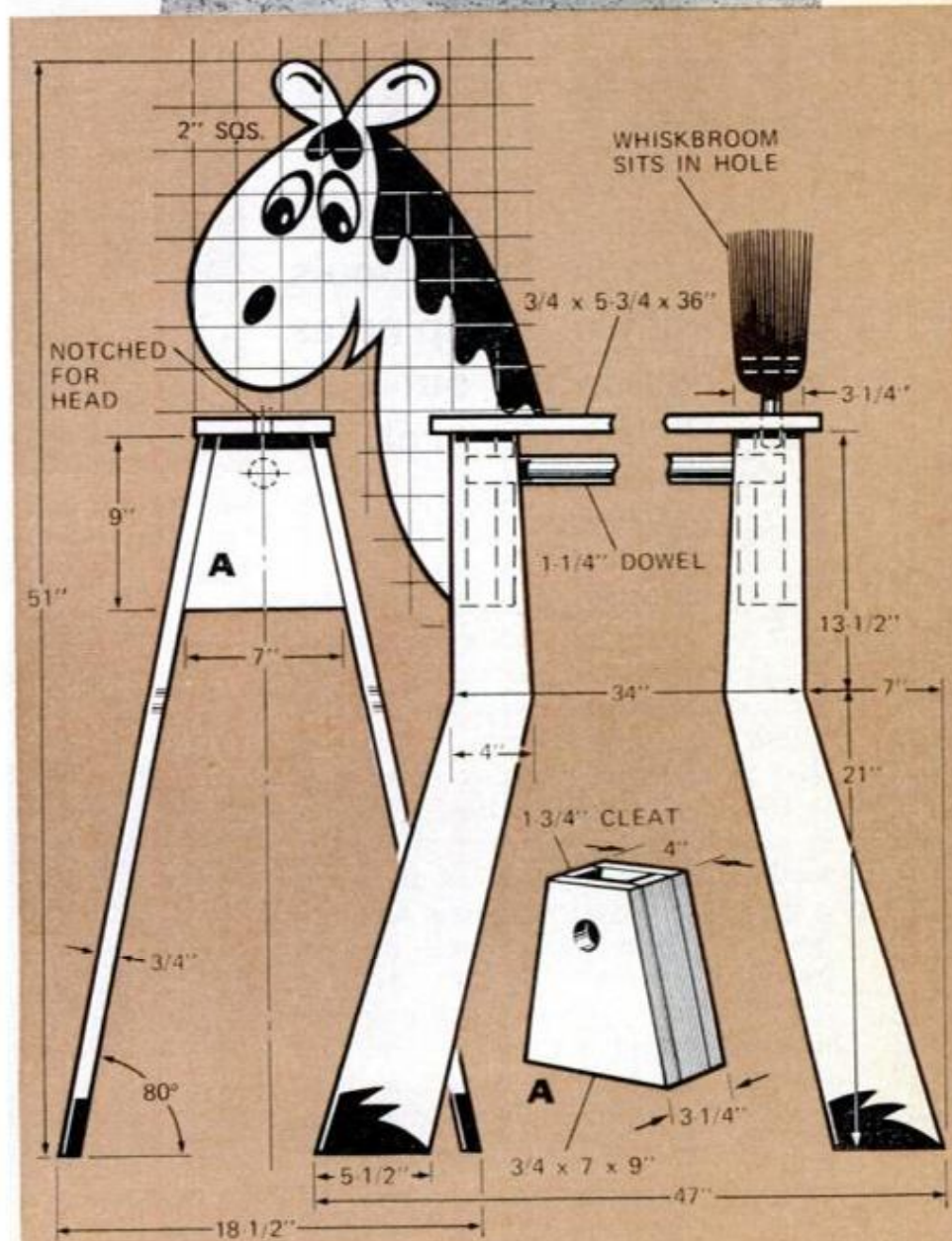
With Charlie Horse around, young cowpokes will soon learn the habit of neatness and be eager to hang up their clothes on his clothes-rod body. He's a colorful toy in the bargain since you can climb aboard and take after those rustlers with guns a-blazin'.

The legs are cut from 1x12 boards (actually $\frac{3}{4} \times 11\frac{1}{2}$ in.) with pieces (A) being cut from the waste. The latter form built-up hollow blocks to which the legs are nailed and glued. Notice that facing ends of the blocks are bored for a $1\frac{1}{4}$ -in. dowel. Glue and nail the dowel in place, then add the $\frac{3}{4} \times 5\frac{3}{4} \times 36$ -in. "saddle" which is notched for Charlie's head. After enlarging the pattern on 2-in. squares, trace it on plywood and jigsaw. Glue the head in place and drive long finishing nails through the edge into block (A) and the top board. Paint in lively colors. —E. Dussault, Oak Park, Ill.



Technical Art by Peter Trojan

OCTOBER 1971



Build a Spanish-Style Lamp the Easy Way

With simple hand tools and ready-made spindles you can whip out this project in one weekend

By J. A. LACKNER

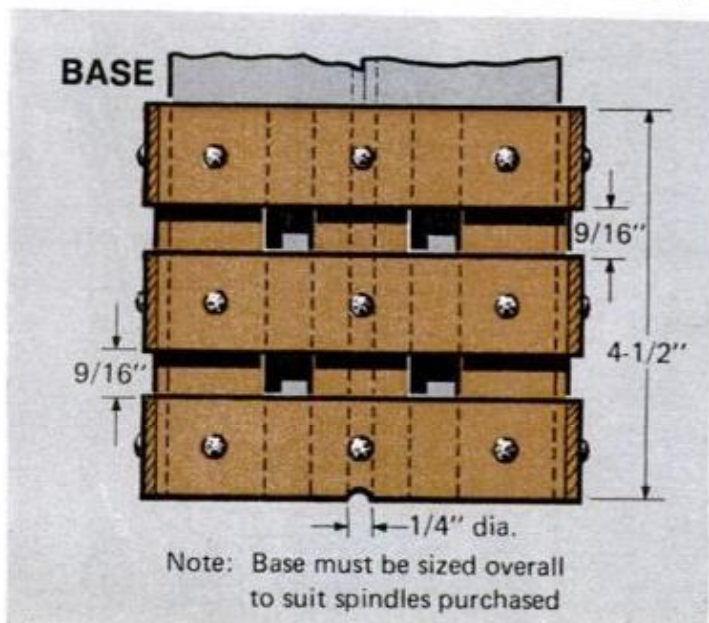
WHY SPEND \$50 OR MORE for an imported Mediterranean table lamp, with its customary heavy, large-scale wood base, when you can build this beauty for a fraction of that price in an evening or two?

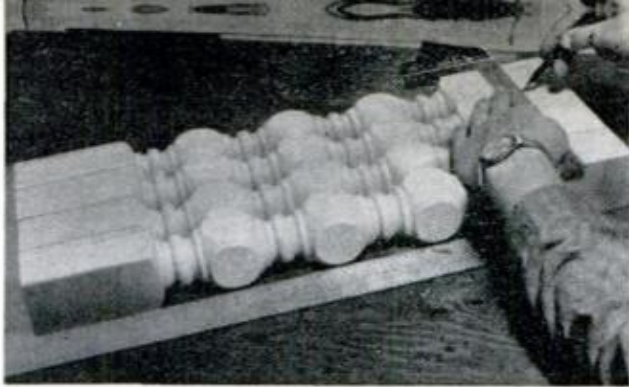
The lamp's construction is greatly simplified by the use of ready-made spindles. They're available in a variety of styles and sizes at lumberyards and most well-stocked hardware stores.

Begin the project by lining up, measuring and cutting the spindles to desired length. Overall length is not critical; determine it so that it places the lamp at the proper height



MEDITERRANEAN LAMP's handsome appearance belies the fact that it's a quick—and satisfying—weekend project

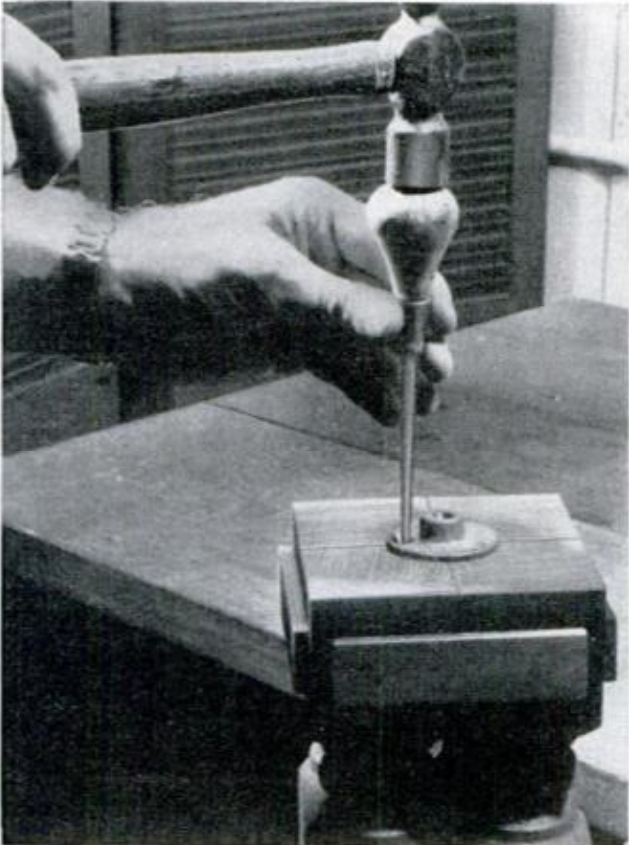




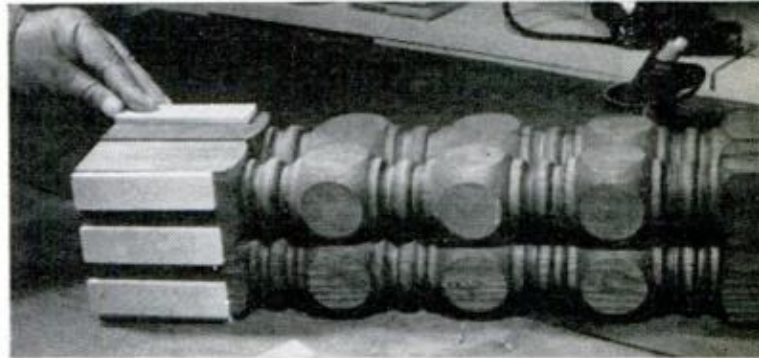
SPINDLES are lined up, measured and cut to length. Use a planer blade and you'll eliminate sanding job



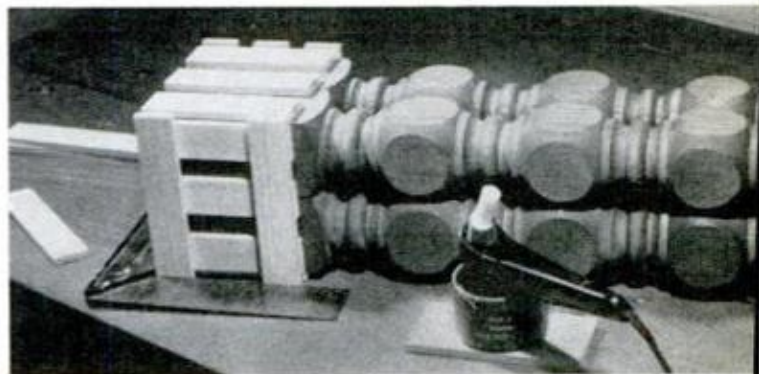
HOLES are drilled through the centers of the top and the base of the column. Use a 1/4-in. drill bit



PIPE FLANGE is centered on top of column. Mark and punch the pilot holes but do not fasten at this time



VERTICAL SLATS on base are placed and glued. Measuring isn't necessary; they can be placed by eye



HORIZONTAL SLATS were affixed using hot-melt glue gun (shown parked in discarded aerosol can cover)

for the place you want to use it. All four spindles must be the same length.

Because it will be impossible to get inside the column once it is assembled, each spindle should be stained before assembly. Do *not* stain those surfaces which will mate and receive glue. If you use a Thermogrip hot-melt glue gun, as I did, assembly is speeded up. If you use white glue, it will be necessary, of course, to clamp the pieces overnight before proceeding with the slats and electrical work. The base-surround (slats) is made up of 1/4 x 1 1/8-in. lattice strips. And once these are added, the lamp should be freestanding. If the lamp wobbles, true up the bottom with a block of wood covered with coarse-grit sandpaper. Dowel buttons were

used for accent but, if preferred, round-head tacks can be substituted. For rustic effect, these buttons can be painted black.

Drill a 1/4-in. hole through the top and bottom of the lamp to receive the lamp cord. Also, for the cord, cut a small half-circle channel in the bottom from the hole to one edge of the base. A pipe flange (painted black) goes at the top of the lamp and you're all ready for the electrical part of the job. If you can't get the lamp parts locally, they're available by mail from Sears or from Albert Constantine and Son, Inc., 2050 Eastchester Rd., Bronx, N. Y. 10461. Lampshades, of course, can be found in department stores. This permits selecting a color and pattern that will blend with room decor. ★★★

YOU CAN INSTALL A WASTE DISPOSER

By doing the work yourself, the labor cost you save may well pay for the disposer

By WAYNE C. LECKEY, Home and Shop Editor

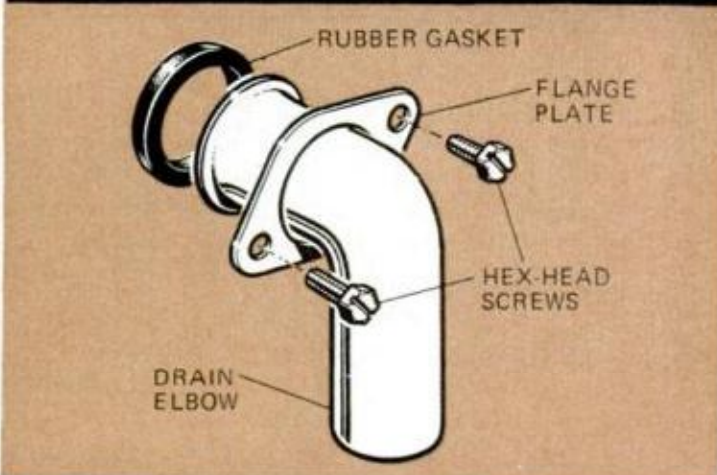
Photos by Robert D. Borst

IF YOU HAVE SHIED AWAY from installing your own food-waste disposer because you figured it was too difficult, you're in for a surprise. Outside of the back-breaking position you have to assume in the cramped quarters under a sink, the job of connecting it to the drain-pipe actually requires little or no previous plumbing experience. It doesn't even involve the water lines.

As for special tools, I installed the Norge continuous-feed disposer shown here with

a pipe wrench, an adjustable wrench and a screwdriver. To wire it, you won't need any more tools than you have in your toolbox.

There are two types of disposers: continuous and batch feed. The first lets you deposit food waste into the unit while it's running, and is operated by a separate switch. A batch-feed unit does one load of food waste at a time. It runs only when a cover is locked over its opening, which triggers a built-in switch. Before you



IF DISPOSER IS SHIPPED with the drain ell detached, you must install it with mounting plate and screws furnished



SINK FLANGE IS ATTACHED by turning slot-head screws in tapped holes of mounting ring

TYPICAL BEFORE INSTALLATION

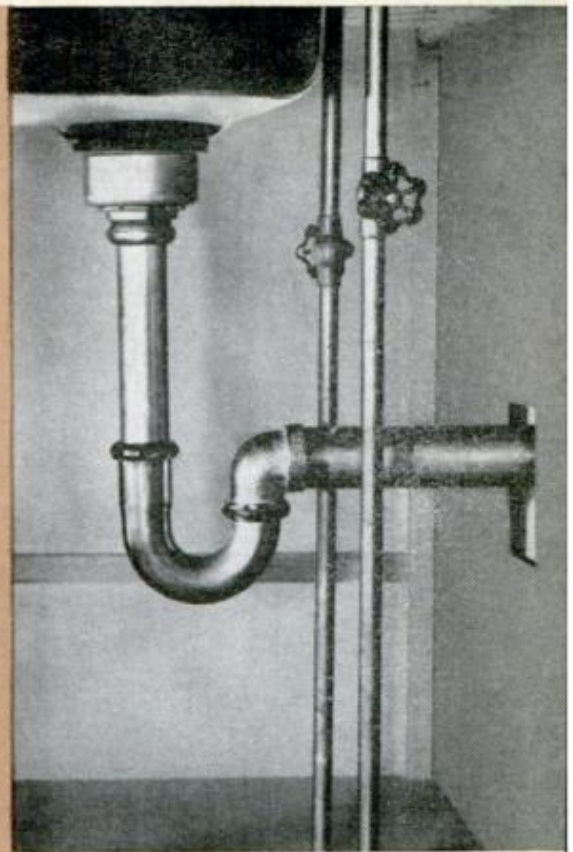
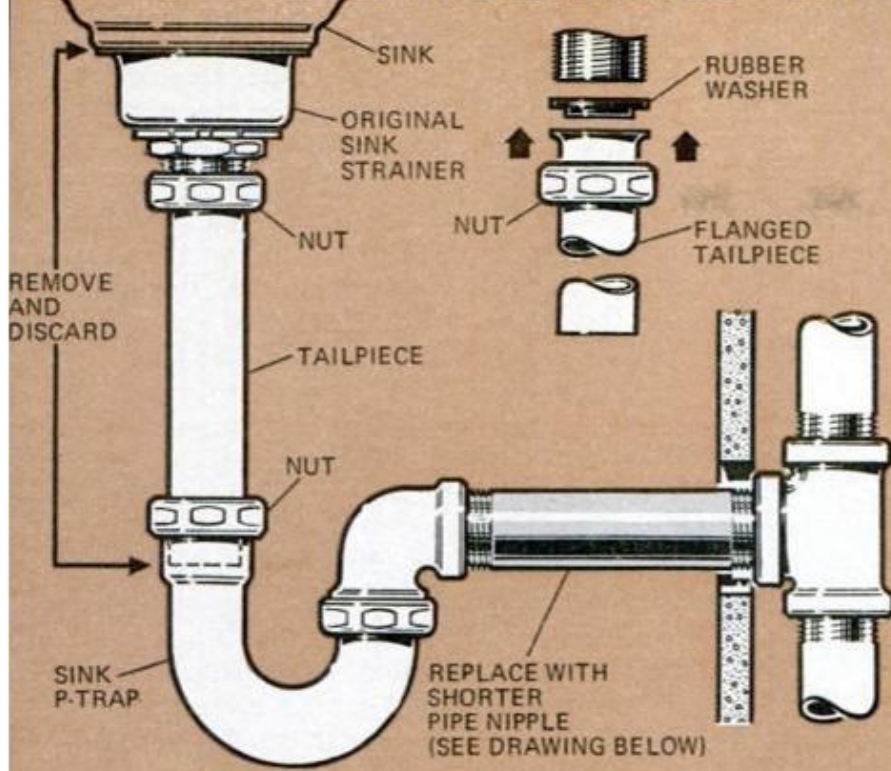


PHOTO SHOWS TYPICAL INSTALLATION of waste pipe for single-basin sink. Valve-fitted pipes are water lines

choose a disposer, I suggest that you read *What You Should Know About Garbage Disposers Before You Buy* (page 158, May '70 PM).

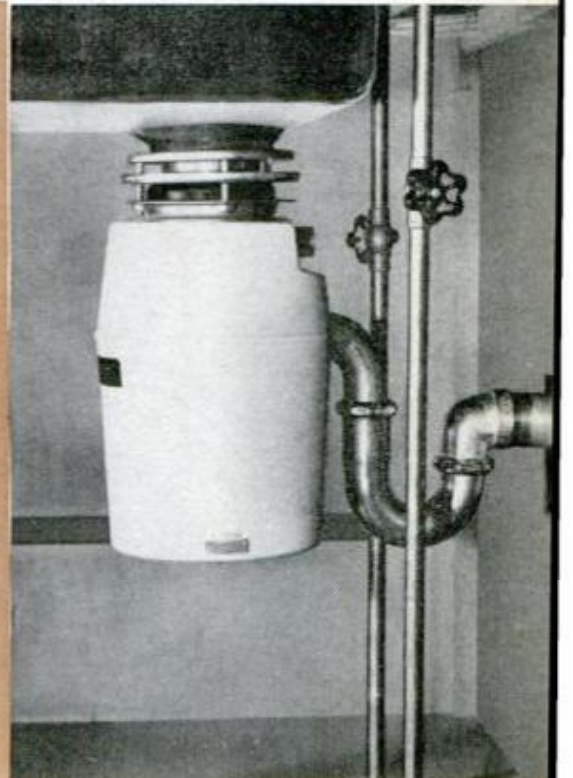
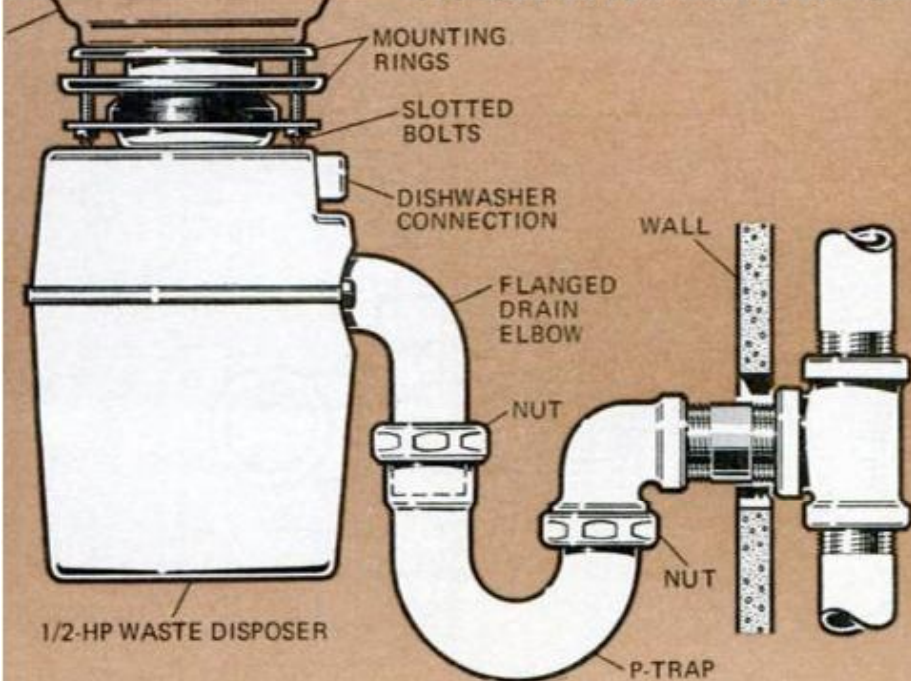
Study the before and after installation drawings and photos on this page. Your particular hookup should look much like

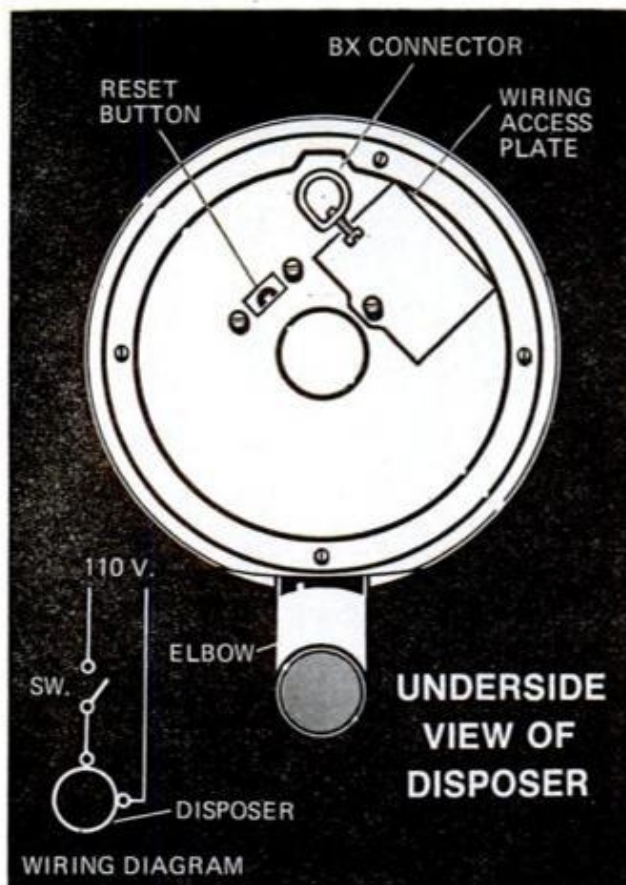
that in the before photo. If you have a two-basin sink, you'll have twin drains which could either go out the back of the cabinet or through the floor.

Since the disposer replaces the original sink-strainer assembly and tailpiece, these parts are removed (as indicated) and dis-

PHOTO SHOWS DISPOSER INSTALLED in the above set up. Notice that same trap is used but waste pipe is shorter

TYPICAL AFTER INSTALLATION



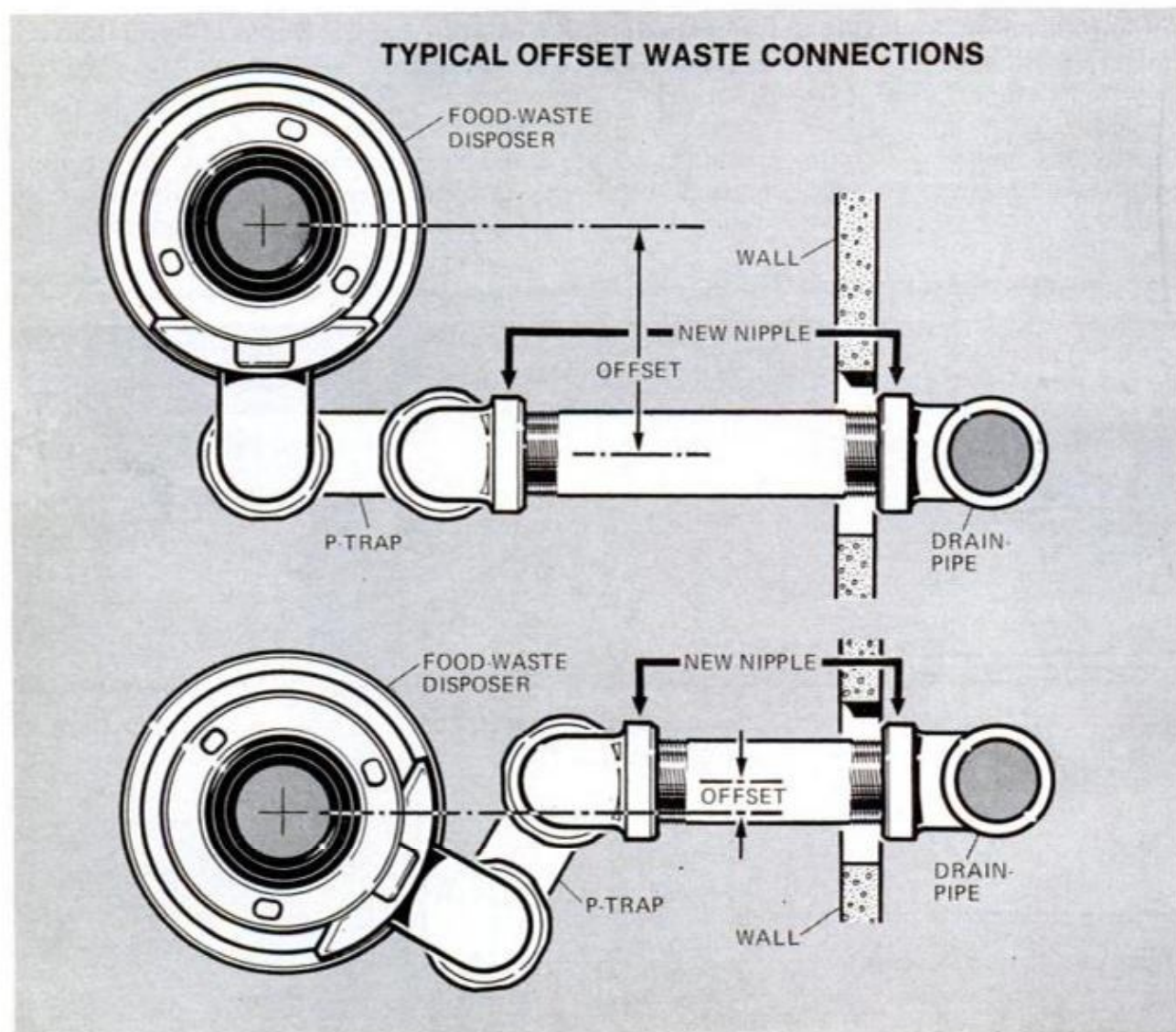


carded. You simply back off the two nuts that hold the tailpiece to the strainer body and P-trap, and then the nut which holds the P-trap to the waste pipe. Use a flat-jaw adjustable wrench. To remove the strainer body, just back off the flat nut which holds it.

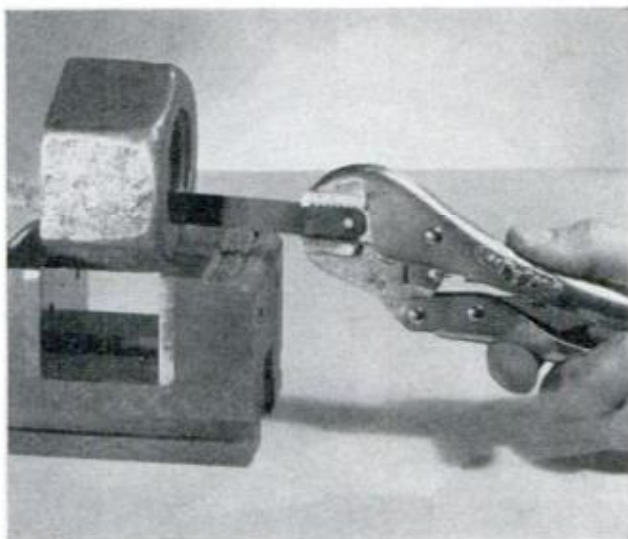
Because the disposer requires a shorter waste pipe than the original, you then unscrew the old nipple from the drainpipe in the wall, using a good-size pipe wrench—if the nipple is rusted or corroded, it may take muscle to break it loose. Sometimes a length of pipe slipped over the wrench handle gives the extra leverage needed. Now you are ready to install the disposer.

Your particular disposer dictates the way it attaches to the sink. In the case of the Norge (Fedders Corp., Edison, N.J. 08817) that I installed, a separate mounting ring with slotted screws locks the sink flange in place. Before it can be installed in the sink, a snap ring has to be pried off

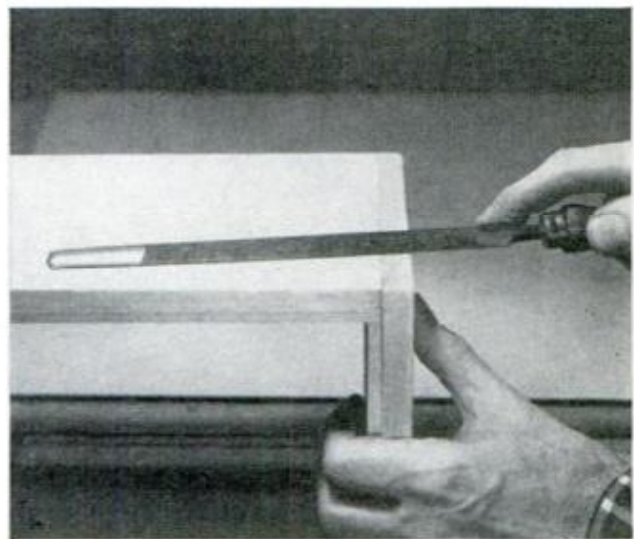
(Please turn to page 204)



40 GREAT HINTS TO SAVE YOU TIME AND MONEY



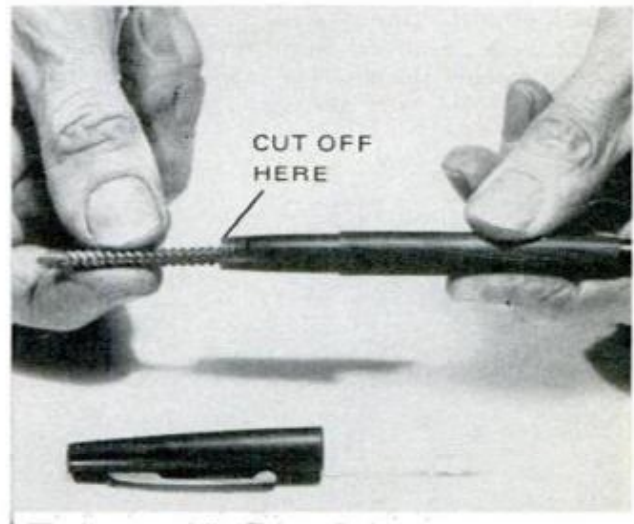
WISE-GRIP PLIERS make a safe and comfortable "handle" for close-quarter work when it's necessary to use just the blade of a hacksaw. Simply adjust the pliers to grip the blade by the edges and clamp



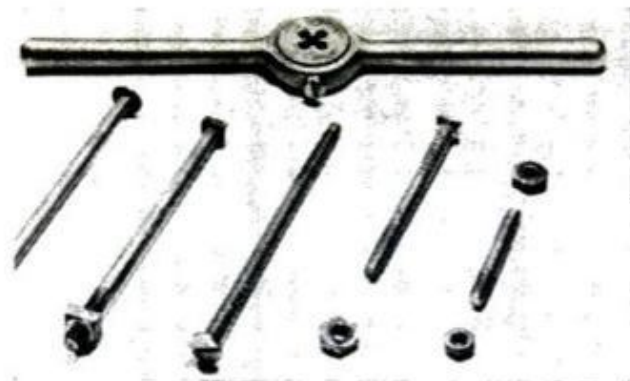
RASP SCRATCH, on what will be a visible finished surface, can be prevented by wrapping several turns of masking or friction tape around the file for an inch or so from the end. Keeps file from digging in



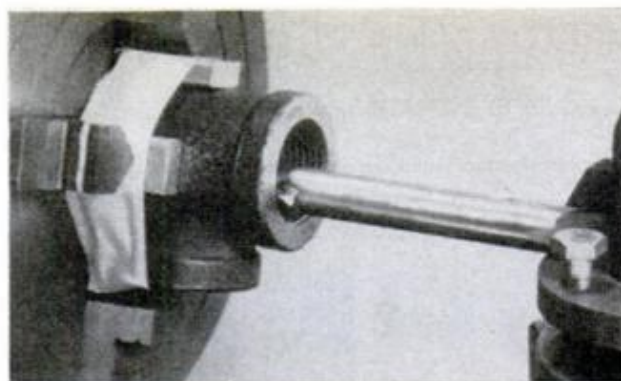
SPREAD GLUE EVENLY in dowel holes by using a bolt slightly smaller in diameter. Works better than a brush; bolt threads hold more glue and when the job's done, it's a lot easier to clean bolt than a brush
OCTOBER 1971



PROTECTIVE CASES for carbide-tipped drills and like items can be fashioned from discarded felt-tip pen cases. Simply cut off the end with a sharp knife and pull out wick. Use various colors for a key-code



HOMEMADE BOLTS can be made from large nails when you lack bolts of the right length. A 20d nail, when threaded with a 10/24 die, becomes a 1/4-in. bolt. Heads can be slotted or squared off on grinder



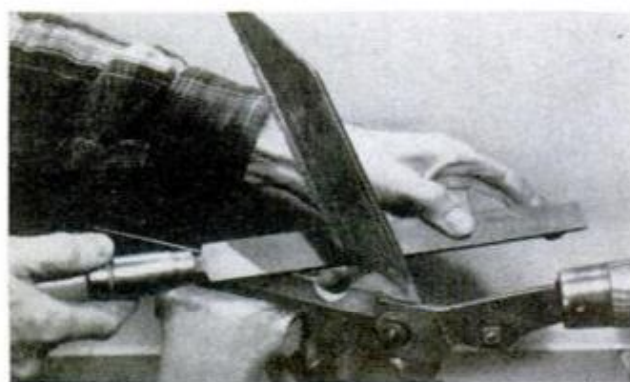
WHEN CHUCKING irregular-shaped castings, which require the use of spacers, in a four-jaw chuck, two hands frequently aren't enough. However, if you first tape spacers to casting, two hands will be enough



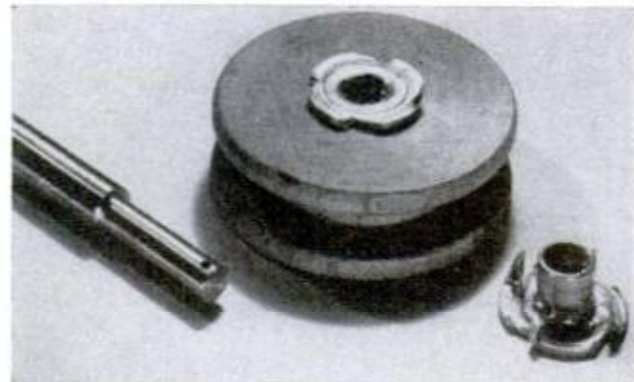
QUICKIE PAINT STRAINER can be made on the spot if you use a plastic coffee-can cover with the center cut out to hold the straining fabric over the top of the can. An old nylon stocking is good for straining



ELECTRICAL JUMPER for troubleshooting appliance motors is rigged from length of grounded line cord. Ground clip should be of a different type than other clips to prevent wrong hookup and possible short



HEDGE SHEARS will cut better and won't slip off if you add some teeth to the blades. After sharpening, draw a coarse file diagonally across the edge of the blades while holding the file at an angle as shown



METAL BUSHING for a wood pulley or wheel can be quickly improvised by using a Teenut. If axle is a bit large, the Teenut can be drilled or reamed out to fit. The nut is hammered into a hole drilled in pulley

POPULAR MECHANICS



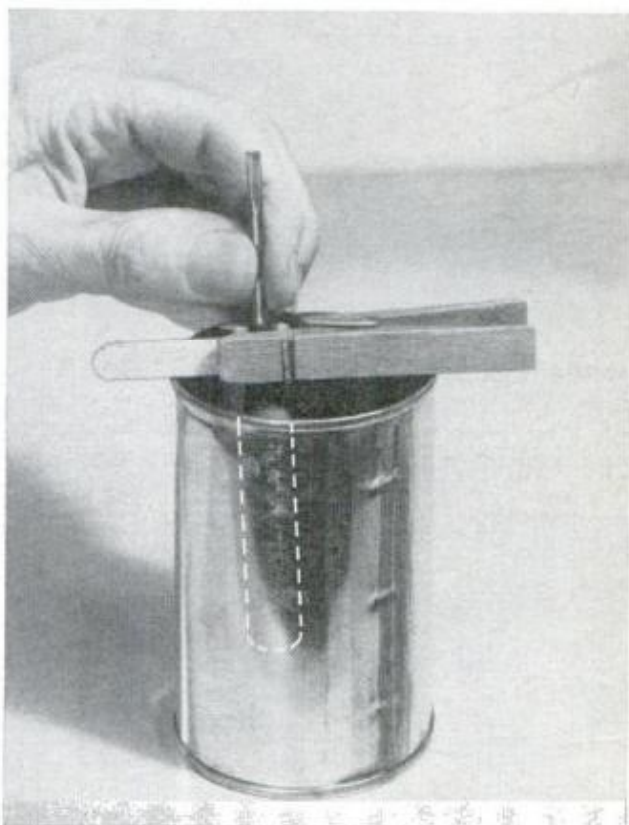
NAIL SETS, because of their size, have a way of becoming "lost" when you need them most. To keep yours always at hand, slip a pencil clip over the shank and set will always be handy clipped to pocket



TOURNIQUET CLAMP for small gluing jobs can be improvised from a length of rope by means of square knot shaped in a loop and an Allen wrench. Wrench is inserted in knot and cranked to twist rope tight



DECORATIVE WALL POCKET for holding all sorts of things can be made from a soft clay flowerpot. Saw it in half with a hacksaw, then attach to perforated hardboard with wire under rim and twist on back



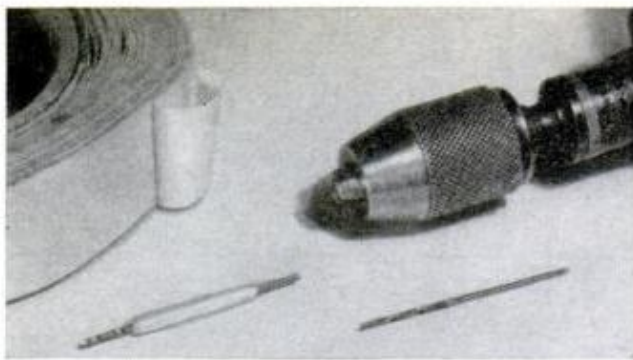
DIP-PAINTING STUNT makes play out of coating tool handles and such to a desired depth. Clamp a spring clothespin to the handle with a stick between. Pin rests on one side of can and the stick on the other



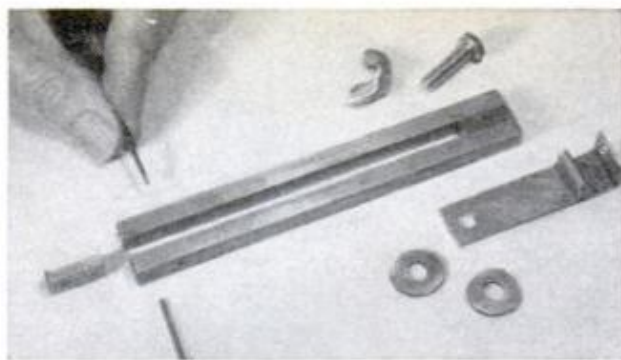
METAL EYELETS and tubular rivets can be used to center screw shanks in oversize holes and increase bearing area much like a cup washer. Eyelets can be used with both round and oval-headed wood screws



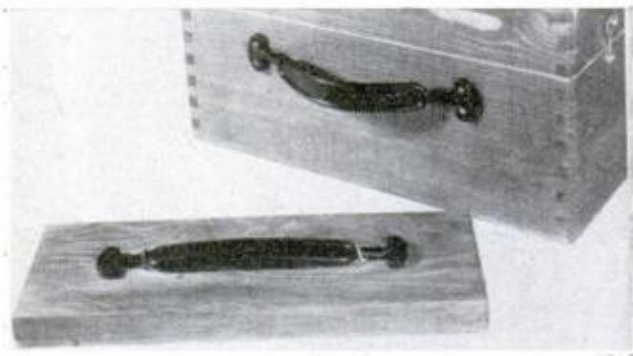
ROLL PENNIES QUICKLY (and without aggravation) by using centerfold of an open book or magazine. Coins stand erect when wrapper is placed over centerfold making it easy to roll and crimp wrapper ends



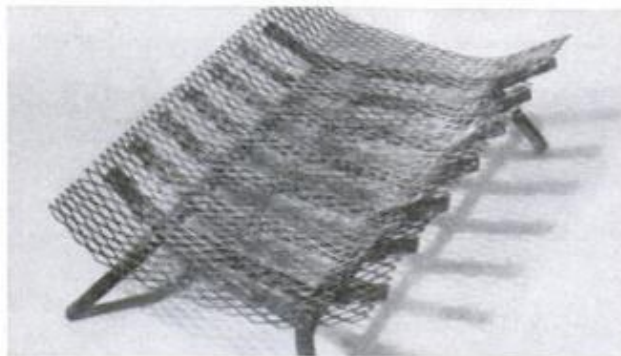
SLENDER TWIST DRILLS which have a tendency to bend, particularly when used in a hand drill, can be kept straight by wrapping several thicknesses of smooth paper tape around shanks to form stiff tubes



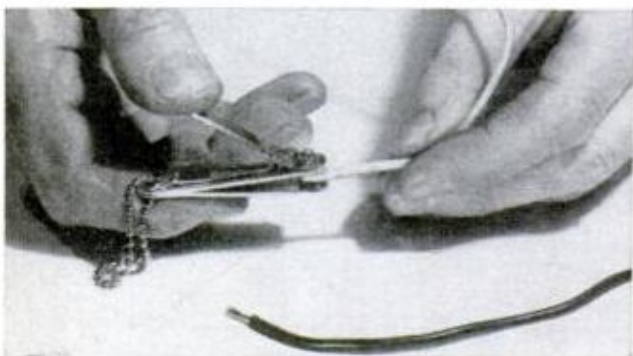
SLOTTED BAR is made the easy way from square bar stock using a spacer at each end. Pieces are held together by brazing or riveting. You'll find it simpler than cutting a slot in a solid bar by hand



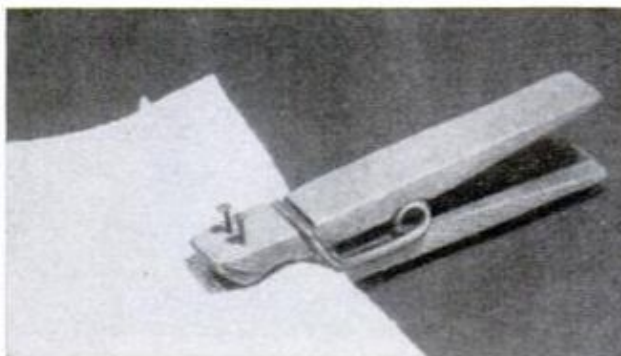
LARGE HANDLES which come on king-size boxes of laundry detergents can be put back to use as pulls on shop projects. They can be drilled for screws, or straddled with staples so they'll slide and lie flat



ROAR, FIRE, ROAR. You'll provide better draft for a woodburning fireplace if you line log grate with piece of mesh like metal lath. It lets air reach embers from both sides, keeps embers against log



WIRE STRIPPER can be improvised in a pinch from your pocket nail clipper. Using some degree of care, insulation can be cut without damage to wire, and jaws of the clipper let you pull the insulation off



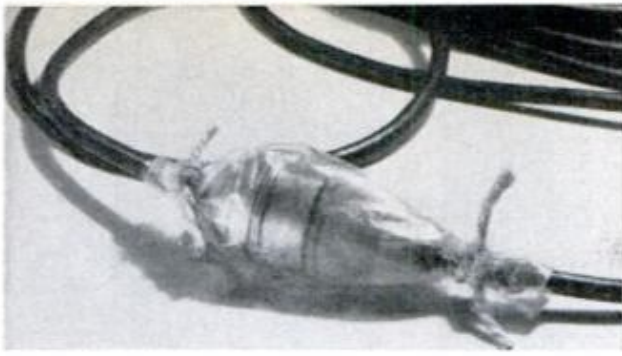
SPRING CLOTHESPIN will hold better when used to hang heavy burlap, canvas and paper if you add teeth to the jaws. This is done by driving small nails through the jaws so they project $\frac{1}{8}$ in. or so



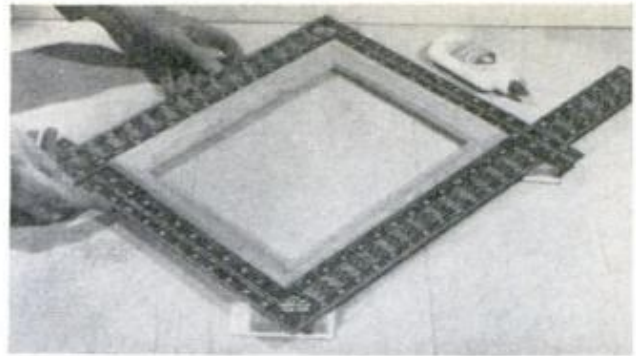
TO TRANSFER HOLE locations from one part to another, try using double-face tape to hold the work. This will free both hands to make the punch marks and the tape will keep the workpiece from shifting



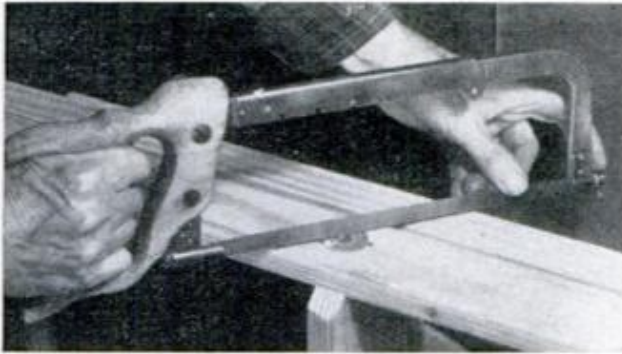
BRUSH WIPER on paint can consists of piece of coathanger wire bent at the ends to pass through holes made in the lid groove. When you finish painting, wire can be removed easily and cover replaced



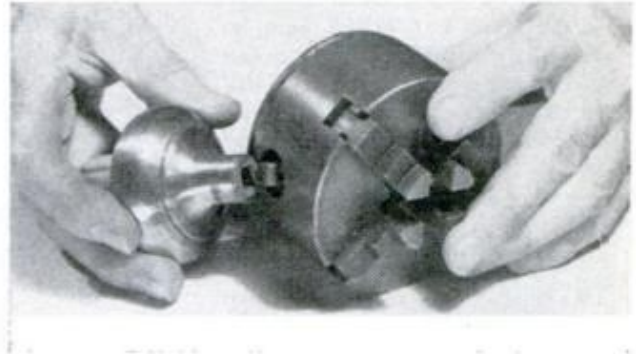
COUPLED EXTENSION CORDS can't pull apart accidentally if you wrap the connection with a plastic bag and tie ends securely with string. Keeps dirt out, and when used outdoors, bag keeps out moisture



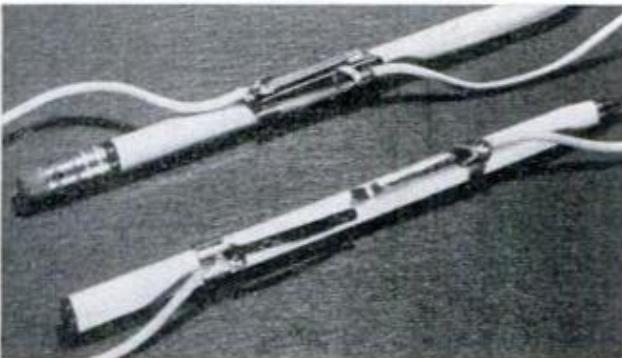
PICTURE FRAMES are sure to be perfectly square when you glue the mitered corners, if you use a pair of carpenters' framing squares. Weight of squares alone is sufficient to hold work without clamping



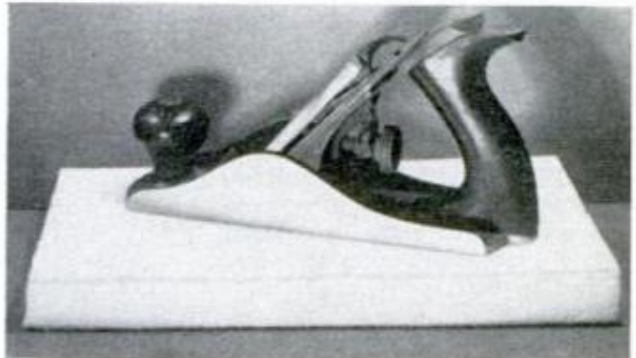
HOW DO YOU TIGHTEN a loose stepladder leg? It's easy if you hacksaw a slot in the heads of the long step bolts to let you tighten them with a screwdriver. You may have to saw into washer to reach bolt head



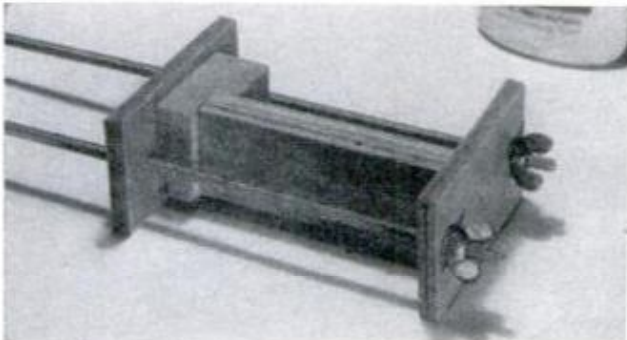
ORDINARY DOORKNOB and a portion of its square shaft can be used in an emergency as a wrench for tightening some types of small lathe chucks. If it's necessary, shank can be filed down to fit chuck



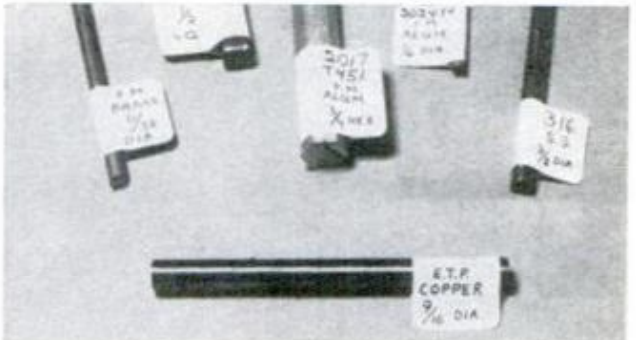
EMERGENCY SLIDE-SWITCH for low-voltage wiring can be improvised from a pencil and two pocket clips. Wires are attached to ends of clips, and ball tips make positive contact when slid over each other



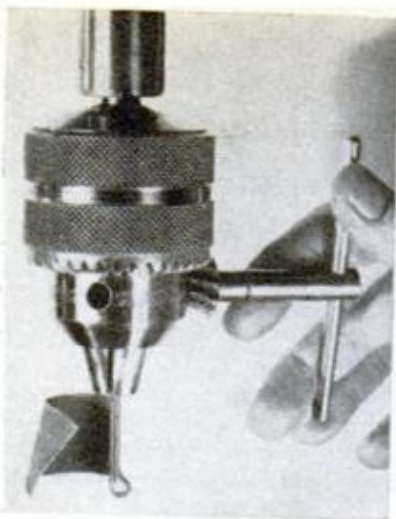
NEVER PARK A PLANE on its planing surface unless you have a soft plastic-foam pad for it. Otherwise you'll wind up with a dull blade. This way, pad lets blade sink into foam and grit particles can't dull it



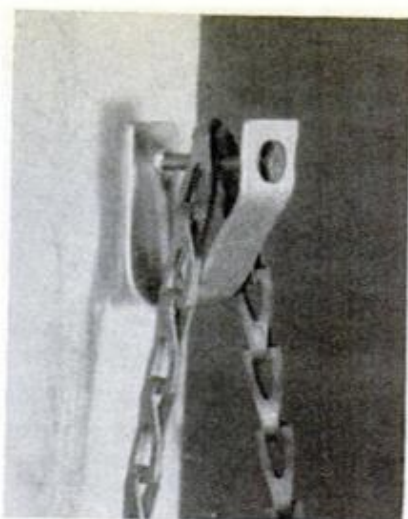
HANDY "VISE" for holding glued items can be shop-made from two threaded rods, four wingnuts and washers and two pieces of 1/4-in. hardboard or similar material to provide sturdy nonsplitting jaws
OCTOBER 1971



FLAG-TAGS made from pressure-sensitive labels are excellent means for identifying accumulations of bar stock in your shop. For permanence, use an indelible felt-tip marker to write on the labels



SMALL INSIDE CURVES can be sanded by wrapping cloth-backed adhesive around a cotter pin. Use the straight portion of the pin only to sand to desired contour



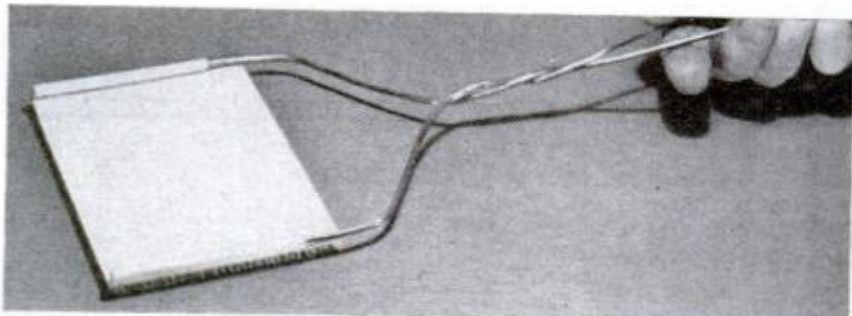
A COMMON NAIL can be discouraged from bending under weight if driven through holes in a steel strip that is bent in a vee to rest flat against the wall



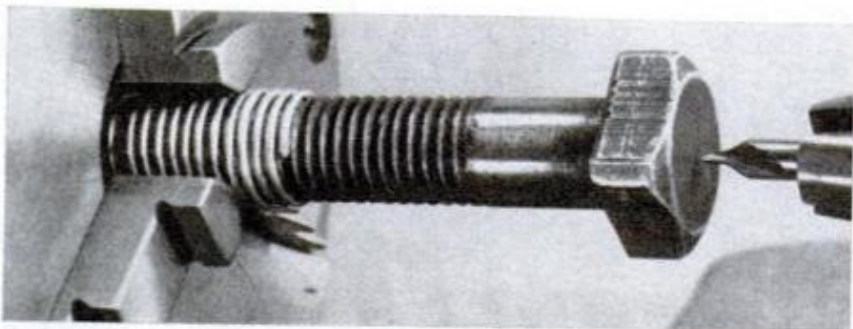
DRIPPY OIL SPOUT can be avoided by placing a leather washer about 1 in. down from the tip. Keeps can, and your workbench, free of any unwanted oil spots



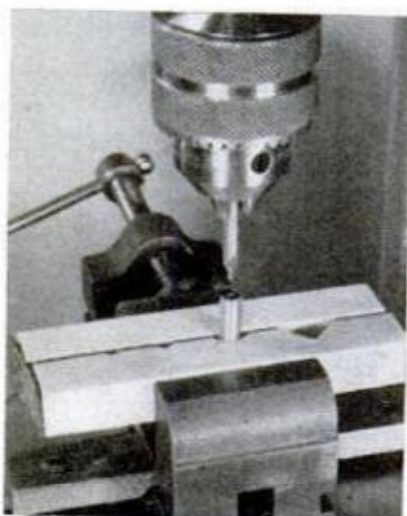
CIRCULAR-SAW BUSHING will frequently fall out when removed from arbor. To make it fit tight, grind eight spots around edge, insert in hole, prick-punch spots



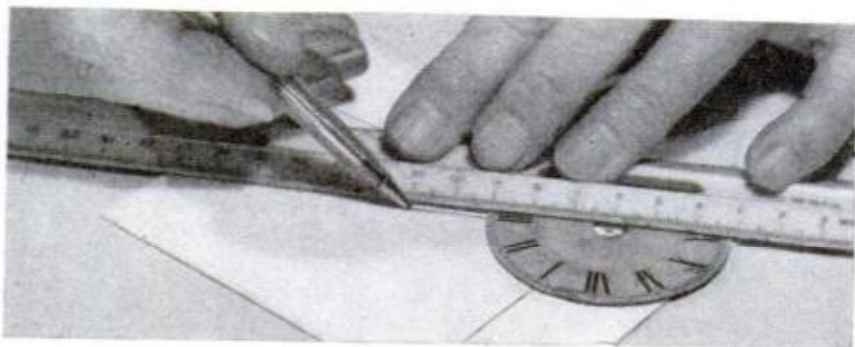
PAD-PAINTER for hard-to-reach spots is made using replacement pad for a Shur-Line edger and an old fly-swatter handle. Pad mentioned has a plastic back with tubular formations that readily accepts wire



TO PROTECT THREADS gripped in a lathe chuck, wrap a length of copper or soft-iron wire around bolt. Wind wire in the form of a spring and make certain that it projects above—and protects—crest of threads



V-NOTCHED BLOCK will hold cylindrical pieces in a drill-press vise without marring them. For permanence, hinge one end of the jig with a piece of inner tube



OLD CLOCK DIAL will serve as a protractor in an emergency. Each minute represents 6° ; thus 5 minutes, 30° ; $7\frac{1}{2}$ minutes, 45° . Angles are measured with a ruler with respect to the center of the hole in the dial

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Low-Cost Way to Add a

Equipped with rotary wood rasps, you can shape your own moldings with just your portable drill and a bench stand

By HARRY WICKS, Workshop Editor

Photos by Robert D. Borst

HAVING BOTH a router and a shaper in my shop, I must confess I tackled my shop test of rotary wood rasps used in a portable drill with an "I'm from Missouri" attitude. Frankly, I lean heavily on my router and turn to it frequently on almost every project I tackle. But, hard as I tried, I found these cutters could not be lightly dismissed.

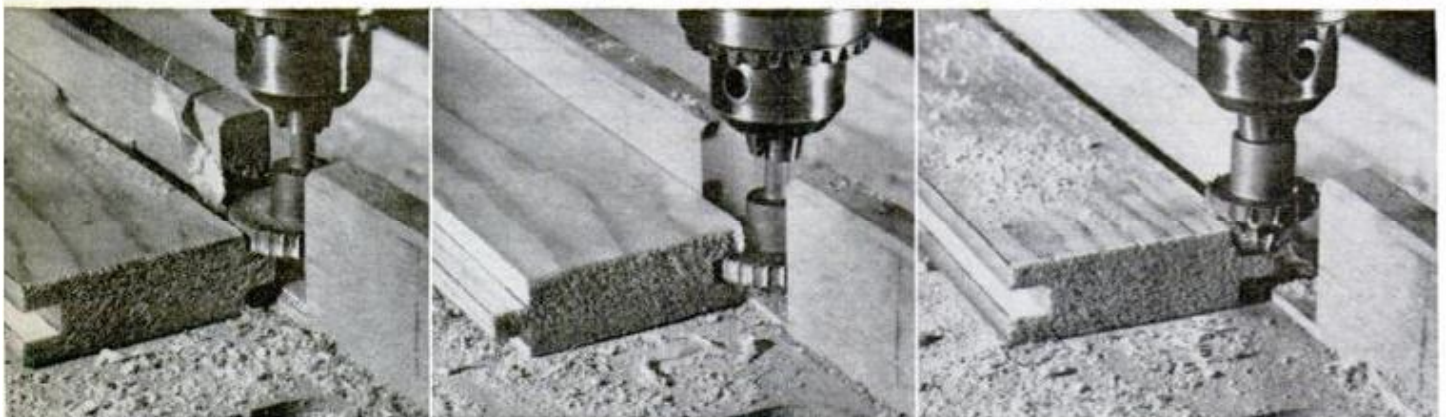
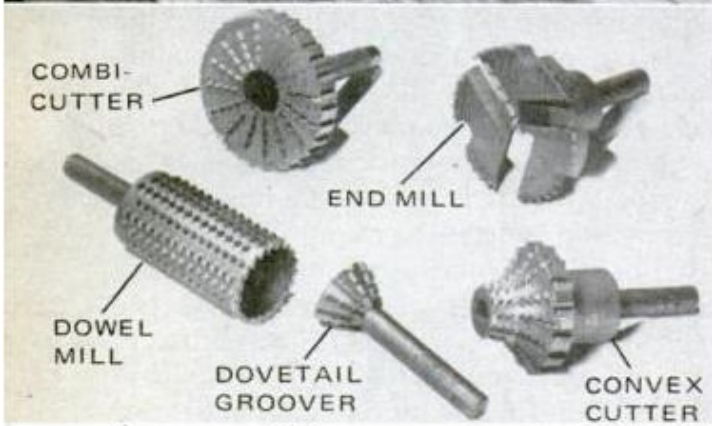
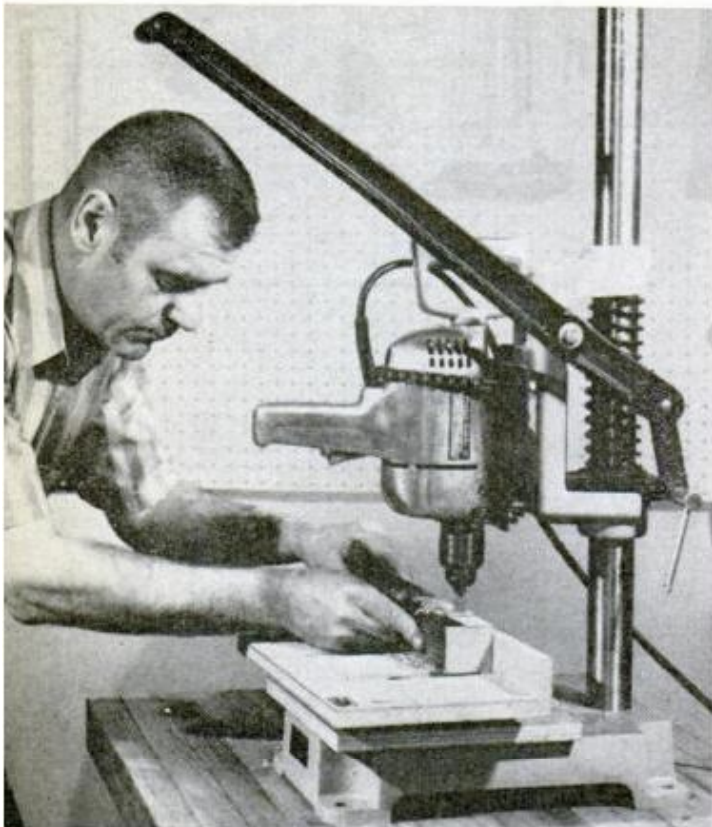
Called System Zenses, the made-in-Germany cutters are relatively inexpensive (about \$5 each) and distributed in the United States by Dal-Craft, Inc., Box 13434, Atlanta, Ga. 30324. They're intended for the do-it-yourselfer; you need no special equipment and the setup occupies very little space.

Since the cutters are designed for use on a high-speed electric drill mounted in a drill stand, an important accessory is a depth stop on the drill-stand column to assure accuracy. The cutters are claimed to last approximately 50 to 60 work hours, depending upon the material you ordinarily work with. Considering that this estimate is based on "in-use" hours, that's a long-life for a typical home-workshop cutting tool.

Included in the line are dowel mills, combi-cutters and angle cutters. They can be used for mortising, planing, rabbeting, recessing and rounding, as well as to shape moldings

FIVE TYPES OF CUTTERS tested in PM's shop are shown above. Rasps do adequate job; take just a little more time than a conventional shaper

TEST BOARD was tongue-and-grooved using combi-cutter (below, left and middle photos). The convex cutter (right) was used to form bevel on meeting edges and, since cut was light, went effortlessly. The maker recommends using a drill with 1500 rpm under load. We used a slower speed drill to make test tougher



'Shaper' to Your Shop

and tongue and grooving as shown in the photo.

The maker claims that the cutters can be used to work plastics and asbestos. I didn't test the rasps in either material, but based on the success that I had with wood, I see no reason to doubt the claim.

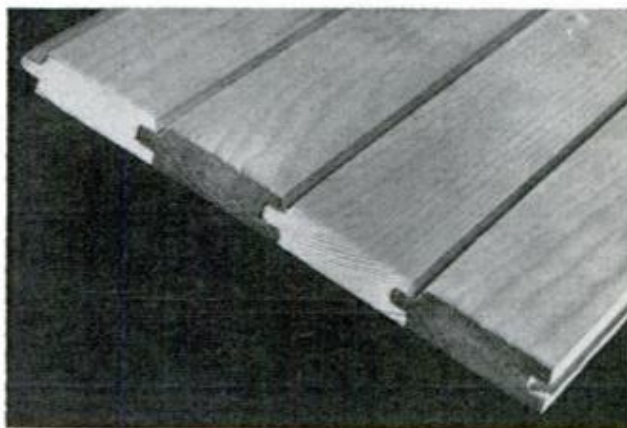
The dowel mill, which is hollow, has a rasp cut on its circumference while the face cut is similar to saw teeth. The primary purpose of the angle cutter is to produce bevels but it can also be used for mitering.

To test the cutters, I set up my 1/2-in. Rockwell drill in a model No. 50501 Rockwell portable-drill stand. I deliberately selected this drill because of its slow speed, but the cutters still did the job as can be seen in the photos. Just for the heck of it, I then tried out the cutters in my drill press at a higher speed. What a difference. There's no question about it, they are designed for use at high speeds and, if used as recommended, come through beautifully. To make the tongue and groove setup shown (above, right), I selected one of the combi-cutters and adjusted its height so that the 1/4-in. groove would be centered on 3/4-in. stock. Boards were then reversed and the cutter adjusted to produce a 1/4-in.-thick, centered tongue. Strictly for looks, I then inserted the convex cutter and beveled the edges.

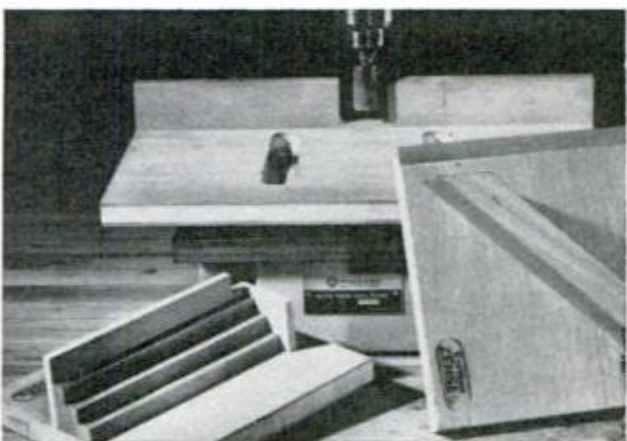
I found there is a tendency of sawdust buildup along the fence which can cause the workpiece to "walk" away from the fence. So, if you build your own worktables, be sure to provide a space at the

rear so the waste will spill away from the work.

For local buying information on the System Zenses Cutters, write to the distributor at the address given on the preceding page. ★★★

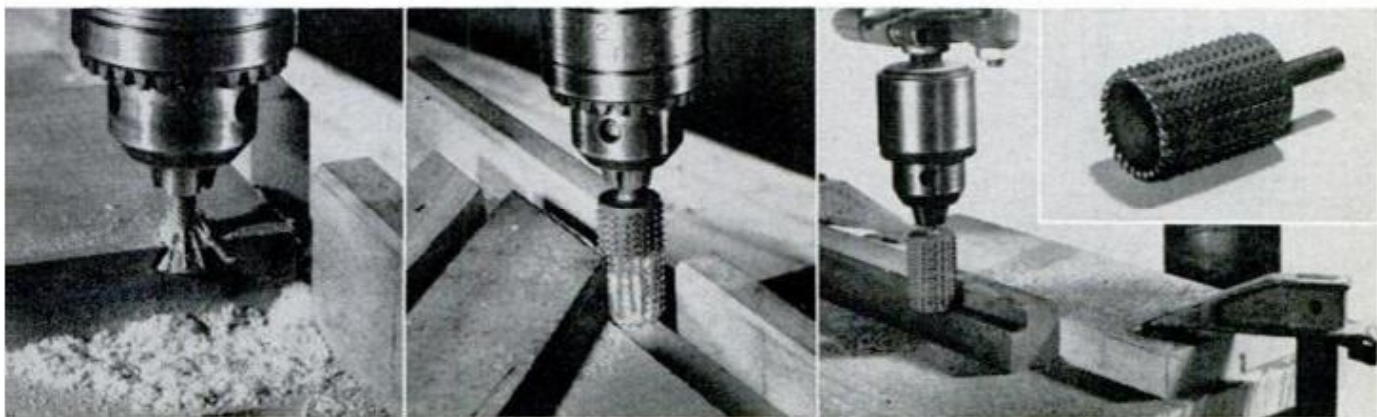


SHAPED PIECES fit together neatly (alternate boards are stained for photo clarity), took only minutes to turn out. Stock used here was 3/4-in. clear pine



WORKTABLES are available from manufacturer if you don't want to build your own. Like the rasps, tables are quality-built and should last indefinitely

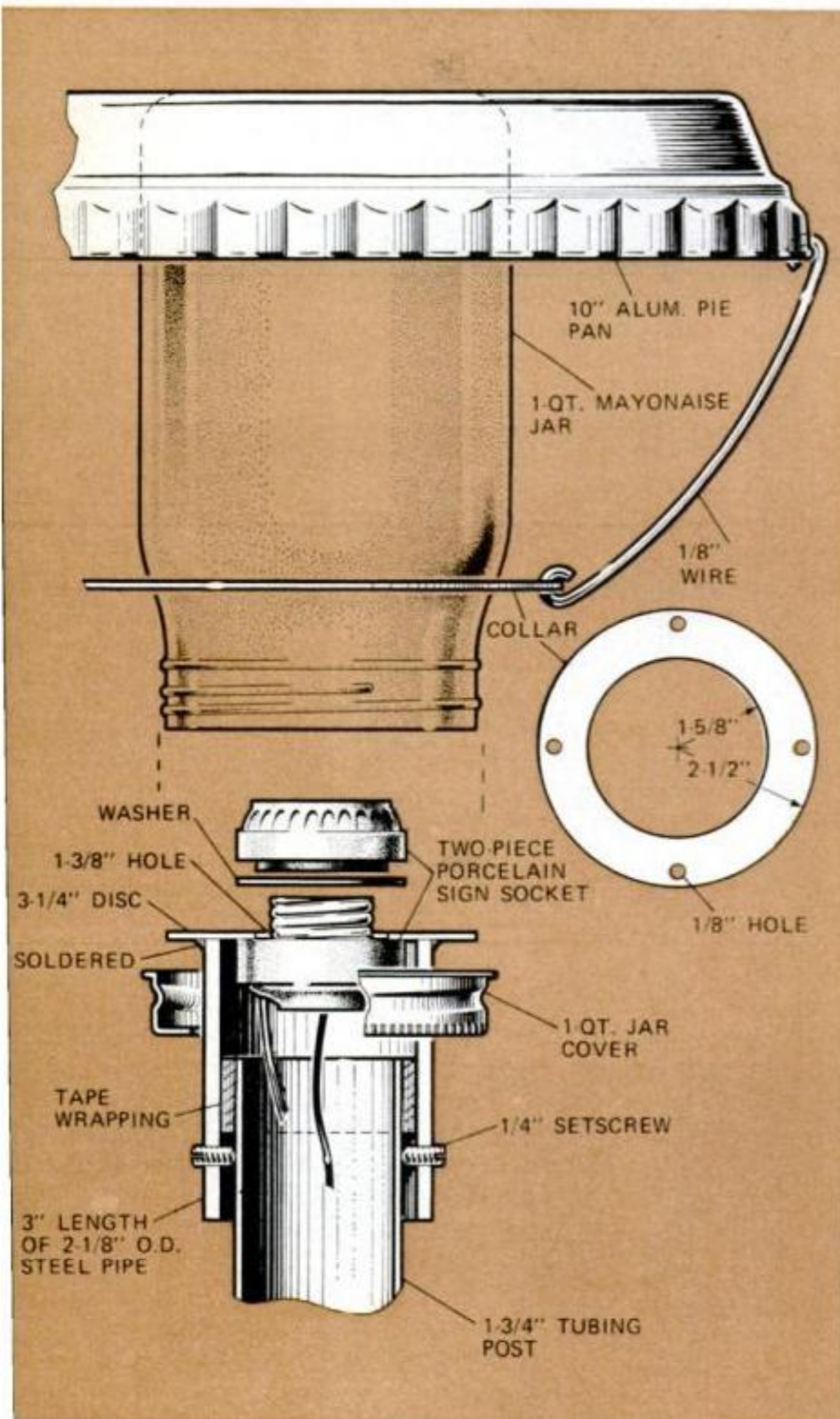
DOVETAIL CUTTER (lower left) chugged away slowly but did the job. In the center photo, dowel mill is being used to true up a poor 45° miter cut. At right, some rasp is used to remove waste and form a rabbet. Author found tools worked best if small amount of stock was removed, the rasp lowered and pass repeated



A Shrubbery Light You Can Make for \$3

By ARNOLD H. HUEHN

Photo by Robert D. Borst Technical Art by Fred Wolff



AN ALUMINUM PIE PAN and a quart mayonnaise jar make an attractive shrubbery light.

The pie pan top is held in place by four wire braces and a metal collar. Cut the collar from 16-ga. sheet aluminum with a circle cutter on a drill press. Make holes 90° apart in both the collar and pie pan for 1/8-in. aluminum wire.

Replace the vacuum-seal jar cover with a metal disc made from a round outlet-box cover with a knockout hole in the center. Enlarge the knockout to accept a standard porcelain sign socket and solder the disc to a short piece of galvanized pipe. The disc and jar cover provide a watertight seal. Three setscrews hold the light to its 1 3/4-in. o.d. post. Friction tape around the top of the 30-in.-long post builds up its o.d. so it fits snugly inside the larger pipe. Use a 40-w. bulb.

For a yard light, attach the light to a 5-ft. post. In all cases, set the post in concrete and bring up ample wire inside the pipe to connect the socket. Run heavy-duty, direct-burial cable underground and wire the light to an inside switch. ★★★

POPULAR MECHANICS



DOWN HOME TASTE!

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20 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report NOV.'70.

181

Install a Three-Way Switch

It's tricky, but these simple

By E. LEWIS FRASIER

THREE-WAY SWITCHES are often thought of as mysterious devices which only an experienced electrician can install. But anyone can wire a three-way switch if he's shown where the wires go. These simple wiring diagrams do just that, and at about \$8 an hour (average journeyman's rate) just think what you can save by being your own electrician.

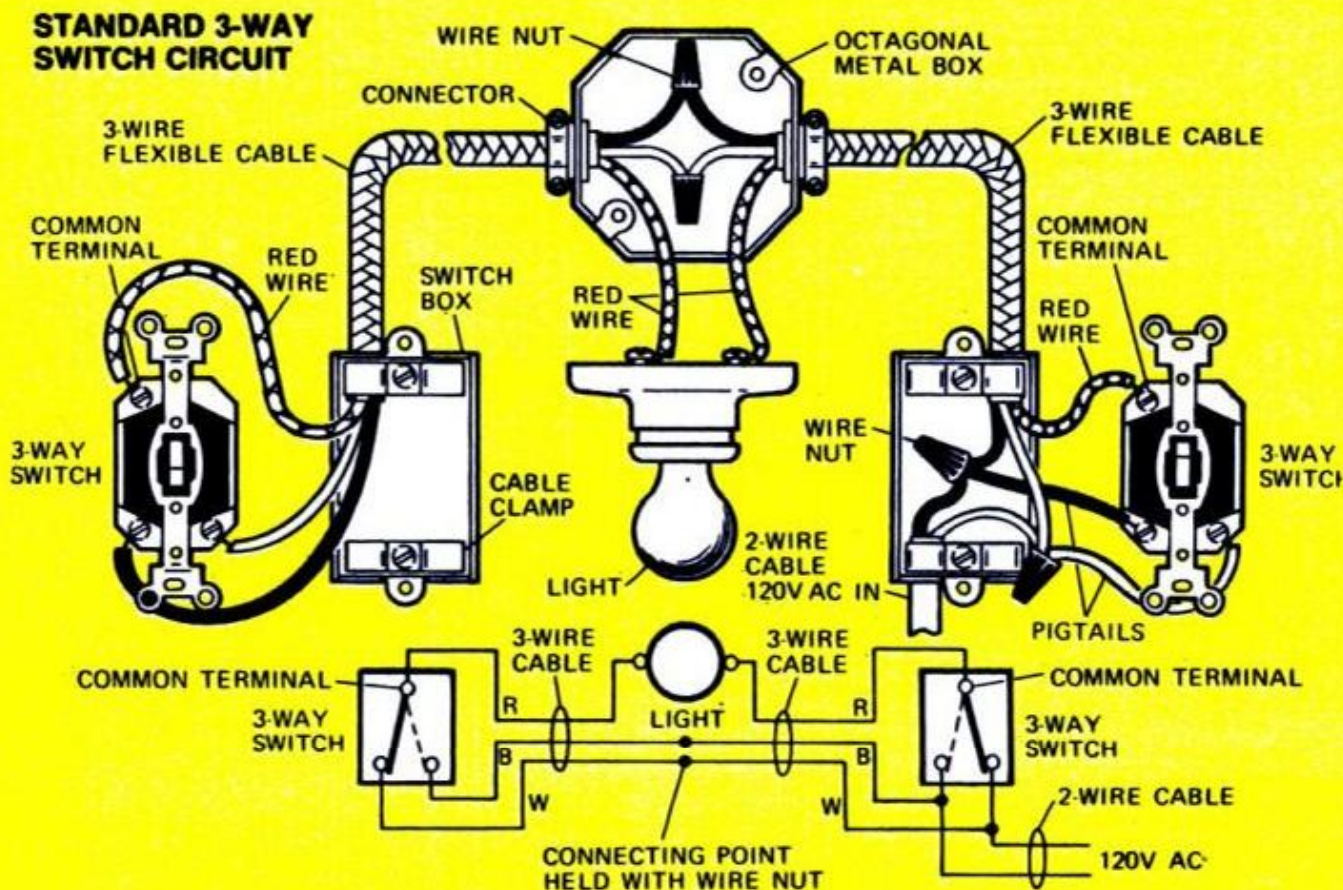
For a few dollars (the price of switches and wire) you can enjoy the convenience of having three-way switches almost anywhere—at both entrances to your kitchen, on both sides of a dining room, upstairs and downstairs for a hallway, in the basement and at the top of the steps and between your back door and the garage.

A basic three-way circuit is shown in the drawing below. Power is delivered to the right-hand switch by a typical 14-2

(two size 14 wires rated at 15 amps.) flexible cable in which the white wire is used as a neutral and the black wire as a "hot" lead. Provided these two wires are properly connected to the first switch, the black and white wires in the 14-3 (three-wire) cable can be connected straight through the light to matching connections on the left-hand switch. The red wire is then connected between the light and the "common" terminal of each switch. This simple procedure insures that color coding is uniformly mated to house wiring, and that it conforms with electrical safety codes.

Identifying the common terminal of a three-way switch is normally easy; the common terminal is usually by itself at one end of the switch. The remaining screw posts are "paired" at the other end of the switch. If you can't locate the com-

PICTORIAL AND SCHEMATIC DIAGRAMS depict standard three-way circuit. A common terminal of switch is generally by itself; notice solid and dashed-line positions within the two switch blocks in the schematic



Yourself? Sure You Can

wiring diagrams show you how

Technical Art by Peter Trojan

mon terminal (when there are four terminals, for example), an ohmmeter will quickly identify it.

If you lack a meter, you can rig two flashlight batteries, a bulb and two short pieces of flexible wire to find a continuous path through the switch. Two size-D batteries are taped together (end to end) in series. The two wires, stripped of their insulation, are taped to opposite ends of the batteries. Then the end of one wire is wrapped around the base of the flashlight bulb. To use, touch one wire to one terminal and the base of the bulb to another. When the bulb lights, you have located a continuous current path through the switch.

Check each of the two positions of the toggle. The common terminal will connect to one of the paired terminals and then to

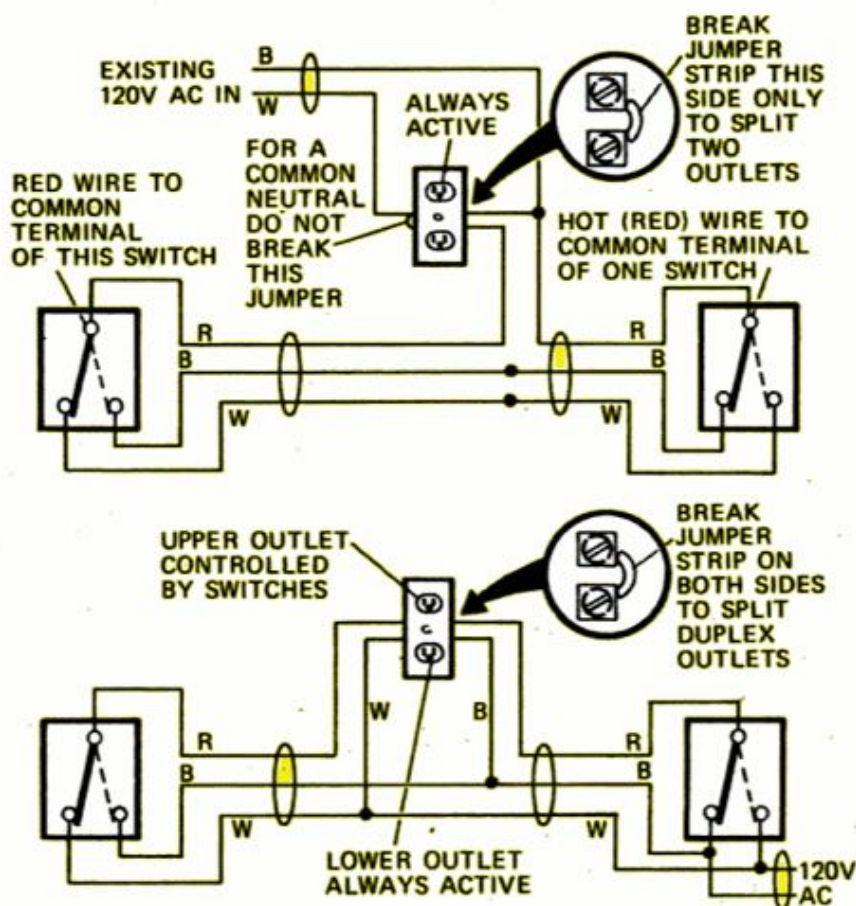
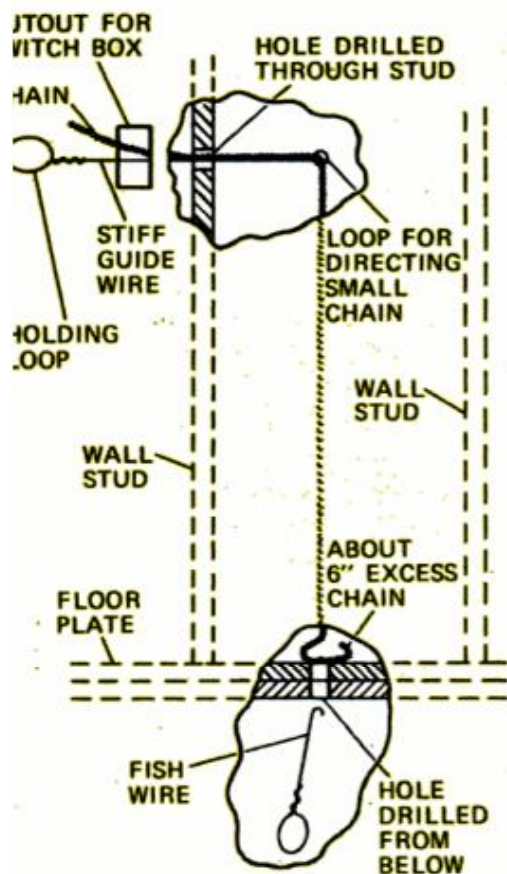
the other. (Observe the solid and dashed line connections inside the switch blocks in the schematic drawing.)

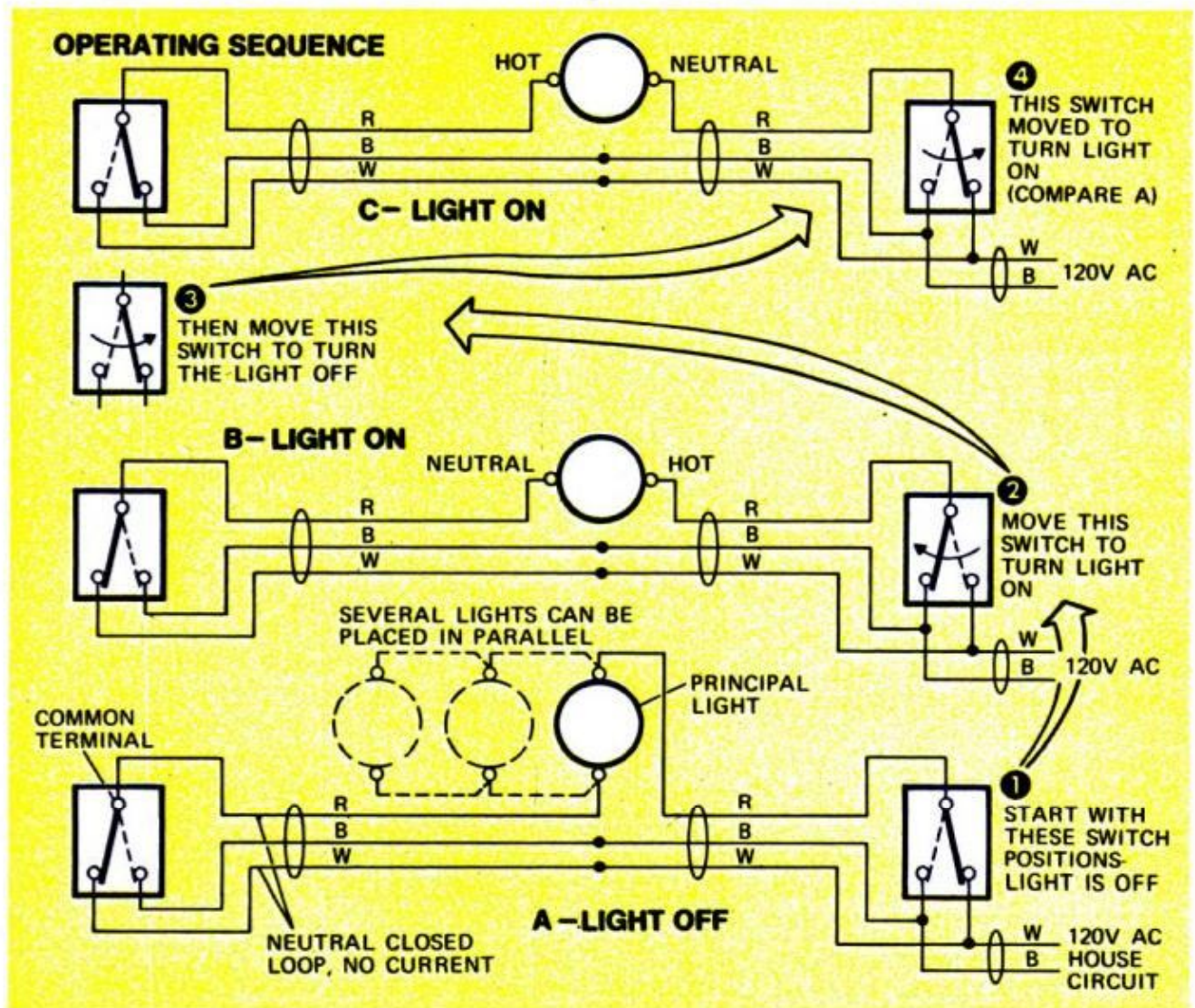
When there are brass screws and a silver screw on a switch, the white wire is always fastened to the silver one. The black or red wire is always connected to the brass screw. This standard procedure is used for two-way switches and duplex outlets, but may not be apparent on a three-way switch.

Though it is possible to wire the switches differently and still have them operate properly (check right-hand drawing below), the standard way has several advantages. The most obvious is the ease with which the color coding of the wires can be made to match the electrical code and the wires connected to existing wiring. With this method there is no doubt that the white

BALL CHAIN, wire hook and loop make it easy to fish the wire through studs

EXAMPLES show split circuits in which one outlet is always active (hot) while its mate is controlled by three-way switches





OPERATING SEQUENCE for standard three-way circuit: When light is ON, either switch will turn it off. When light is OFF, either switch will turn it ON. Trace the red wires from either side of light back to white wire

wire is neutral and the black wire is hot. This leaves the red wire to signal a warning to anyone working with the circuit later on—it may be hot or neutral, depending solely upon switch positions. By examining the numbered sequence and large arrows in diagrams A, B and C (above) you can see why.

Here diagram A is a *schematic diagram* of the circuit shown pictorially on page 182. Within each switch block a solid line shows contact between two terminals, and a dashed line shows the alternate position. Starting at circled numeral (1) with the switches as marked, the light will be OFF. Both sides of the bulb are hooked to the white neutral of the house wiring.

Moving the right-hand switch to its alternate position, as shown by numeral (2), is one of two ways to turn the light ON. The right side of the bulb is hot; the left side is connected to a neutral wire.

Next, moving the left switch to its alternate position—shown by numeral (3) in

the inset of the left-hand switch—is one of two ways to turn the light OFF again. In this case, both sides of the bulb are connected to the hot black wire that feeds the right-hand switch. This forms a redundant loop that does not permit a current flow. (Illumination cannot occur because there is no neutral connection at one side of the bulb.)

Moving the right-hand switch back to its original position as in numeral (4) will turn the light back ON, the neutral wire being on the right side of the bulb and the power on the left.

To install the circuits described in this article you will need these tools: wood and plaster drills, brace and bits, power drill, keyhole saw, screwdriver, sidecutters, knife or cable stripper, wire stripper, long-nosed pliers, pulling chain (or strong, smooth cord), hammer, large staples for anchoring the cable, and screws or nails to mount the boxes. Materials such as two and three-wire cable, solder-

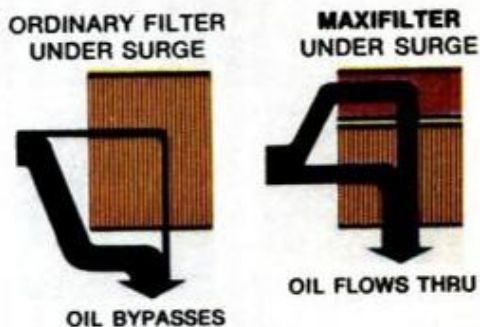
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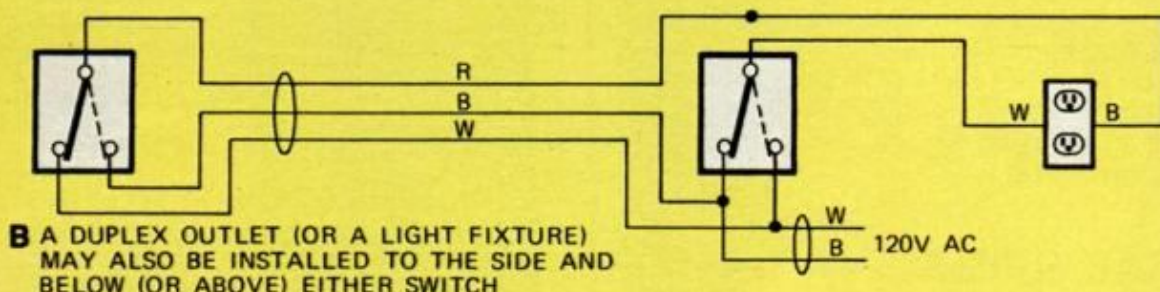
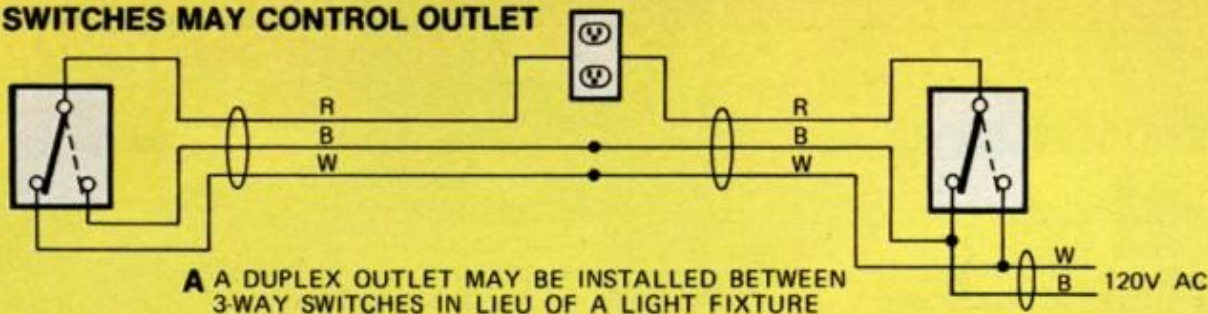


Lee MaxiFilter 1000. Performs as tough as it looks. Be the first to spin one on. Available wherever fine performance equipment is sold. Lee Filters, 191 Talmadge Road, Edison, New Jersey 08817.

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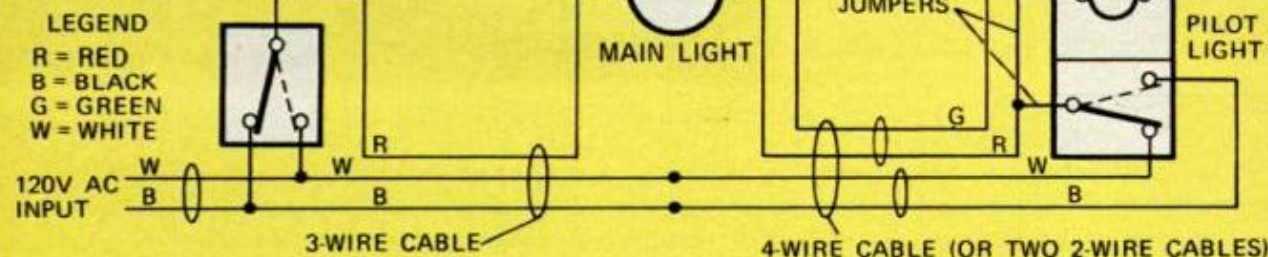
THE LEE ELIMINATORS products for the man who takes personal care of his car

SWITCHES MAY CONTROL OUTLET



THREE-WAY SWITCHES are ideal for controlling duplex outlets that are used with floor or table lamps in living rooms or bedrooms. Lamps can be turned on or off by wall switches as you enter or leave room

C THREE-WAY LIGHTING CIRCUIT WITH SEPARATE PILOT LIGHT. WHEN LIGHT IS ON, THE PILOT IS ON



THREE-WAY LIGHTING CIRCUIT with separate pilot light has a jumper from red wire, plus green wire, to put pilot in parallel with main light. When light is ON, pilot is ON. Some switches have neon pilot in toggle

less connectors, switch boxes, three-way switches, light fixture or duplex outlet, ceiling or wall box, light bulbs, and connectors (to anchor cables in boxes that do not contain a built-in clamp) are all available at well-stocked hardware stores.

A duplex outlet can be rigged between three-way switches in lieu of a light fixture. Controlled outlets are ideal for operating one or two lamps in any room where a ceiling fixture is not available. For example, circuit A in the drawing above, can be used in a living room with one switch at the front entry and the other at a doorway from a dining room, kitchen or bedroom.

Your light or duplex outlet need not be placed "between" the two switches so far as the physical layout is concerned. Circuit B shows how easy it is to use a piece of two-wire cable to place a control-

led duplex outlet to one side and below one of the two switches.

Many duplex outlets are easily divided to make two independent outlets, each fed by a different pair of wires. A typical arrangement is shown in diagram B on page 183. One outlet is always hot, the other is controlled by the switching circuit. The controlled outlet can be used for a table or floor lamp to provide initial (and final) illumination in a room. The continuously active outlet can be used for a radio, record player or television set in the normal manner.

A variation of the split duplex outlet is shown in diagram A. A common neutral is featured in this circuit because the 120-v. input is at the outlets rather than at a switch as in previous diagrams. This situation is representative of an existing

(Please turn to page 198)



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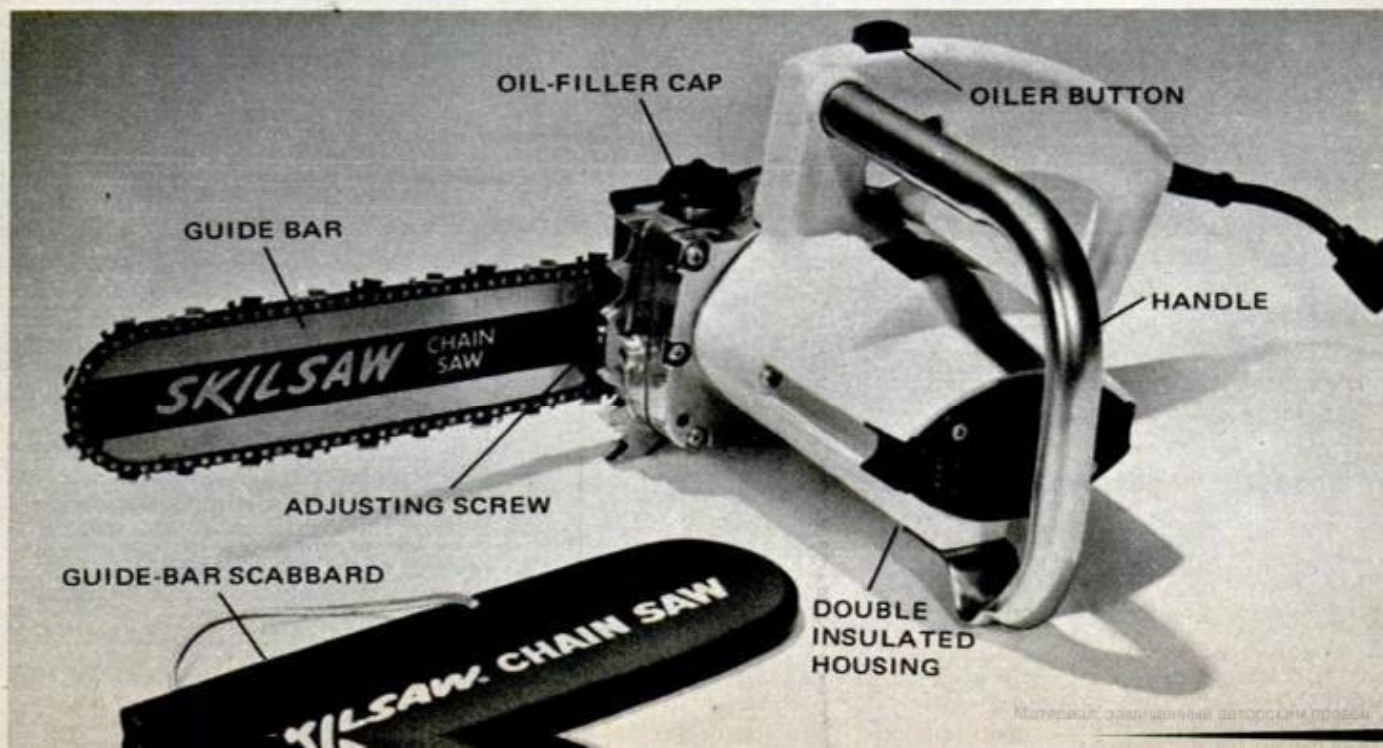
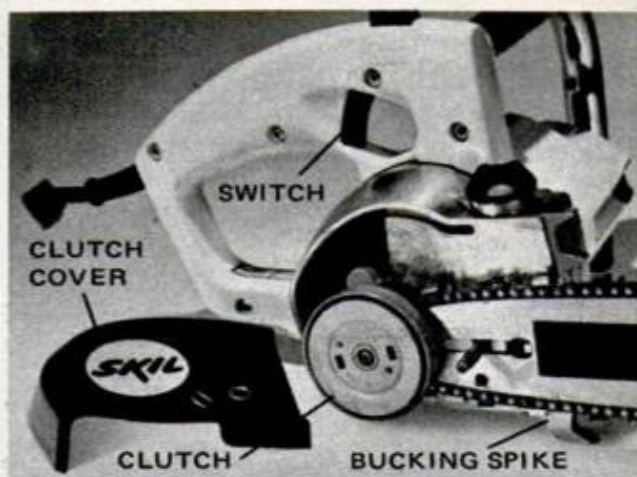
Kings: 20 mg. tar, 1.3 mg. nicotine—
100's: 22 mg. tar, 1.5 mg. nicotine av. per cigarette. FTC Report Nov. '70

PM Tests Skil's 10-In. Electric Chain Saw

WHILE WEIGHING IN at just 9½ lbs. Skil's 10-in. electric-powered chain saw is far from a lightweight with its punch. I found this out when I filled it with oil and plugged it in. A real workhorse, it's the handiest tool a do-it-yourself homeowner could have. Not only was it great for cutting firewood and trimming the trees around the yard, but I also found myself reaching for it when working with planks and heavy timbers.

What I like best about this saw is the ease with which it starts, its relatively quiet operation and that it can be used indoors. The trailing cord didn't bother me as much as I'd expected, even when climbing a ladder. The saw features a double-insulated motor housing and a built-in clutch that prevents motor stalling and chain movement when the motor starts and stops. A special 12-in. bar is available as an accessory. Model 1600 sells for \$89.95 at Skil dealers. For further information write Skil Corp., Dept. PM 1600, 5033 North Elston Ave., Chicago 60630—Wayne C. Leckey, Home and Shop Editor.

WITH POWERFUL 12-amp motor, saw has 2500-fpm no-load chain speed. Extension cords recommended: 16-ga. for 50 ft., 14-ga. for 100 ft., 12-ga. for 150 ft.



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Save Money: Do Your Own Auto Touch-Up

Photos by Robert D. Borst



Spray cans of original car colors make it easy to eliminate minor scratches like an expert

By WAYNE C. LECKEY, Home and Shop Editor

IF YOU CAN come out of a parking lot these days without a scratch, you're lucky. I wasn't. When I got back to my car, someone had gouged the finish on a fender and left with not so much as a "so sorry."

Out of curiosity I stopped on the way home to see what it would cost to have it fixed. Would you believe \$27.50 for a paint scratch 5 in. long?

Busy body shops consider such minor touch-up work as "nuisance jobs" and often don't want to be bothered with them. You can be thankful, for good reason. A crumpled fender is something you can't fix yourself, but a scratch is something else—you'd be surprised what you can save while keeping your car looking showroom new.

Most car owners have done nothing about such scratches for fear of being unable to match exactly the color of the original finish. Now you have nothing to worry about. Dupli-Color Products Co. of Elk Grove Village, Ill., and other makers of auto touch-up lacquers and enamels,

can provide you with an exact match through a stock number identical with the paint number the factory used. All you need to know is the stock number of the particular finish on your car. A color code number is on the car's identification plate (often found on the firewall or door). When checked in a code book at your dealer's, it will give you the stock number. The cap on the can shows the color as well as the car make, model and color number.

There are six basic steps to a professional-looking job. Read them carefully.

- Dirt, oil, wax, grease, polish, rust and fingerprints are the refinisher's enemies, so the first step is to clean the scratched area thoroughly with clean water and wipe dry with a clean soft cloth. Once it's clean, don't touch this surface with your bare skin or you'll have to start all over.
- Now sand the area lightly and this means *lightly*. Use only No. 400 wet-or-dry sandpaper. Fold the sheet and tear into four pieces. Hold one piece as shown at the top of page 194, gritty side out, keeping your thumb out of the act. Dip



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TEAR
INTO 4
PIECES

SCAR IS SANDED LIGHTLY with No. 400 wet-and-dry paper and here is how you hold it to dip it repeatedly in clean water. Paper must be kept thoroughly wet during sanding operation. Tear paper in four

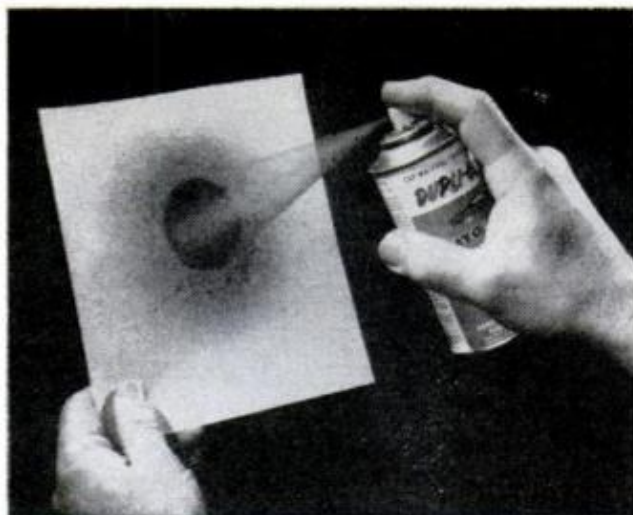
sandpaper, hand and all in a bucket of clean water and slosh it around. When you think the sandpaper is soaked thoroughly (it can't be too wet) start sanding lightly to smooth the scar to a feather edge. Keep the sandpaper wet while sanding by dipping it in clean water frequently. Feathering results when the center of the scar is sanded deepest and the rest of the area tapers gradually to the surface of the original finish. When sanding is finished, go over the area with clean water and wipe dry with a clean soft rag.

- If scar is near glass or chrome, cover it with masking tape and newspapers.

- Bare metal has to be primed for three reasons: It protects the metal from rust. It prevents peeling of the new finish and it builds up the damaged area level with the original finish. Use a touch-up primer according to directions given. When dry, wet-sand the primer as you did in step 2, but do not feather the edges. Sand even with the surface of the original finish.

- A little practice will help you get the feel of spraying. If you don't happen to

[\(Please turn to page 202\)](#)



SPRAY-SHIELD TECHNIQUE is a stunt that's used when touching up nicks and tiny scratches. Spraying is done through hole in a cardboard shield which is held an inch or so from nick. Hole is shape of scar



PRACTICE SPRAYING on a tin can or other metal surface until you get the feel of it. Apply light coats, not heavy ones, and keep the spray moving to avoid sags and runs. Hold spray can 10 to 12 in. away



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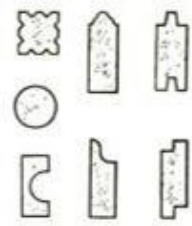
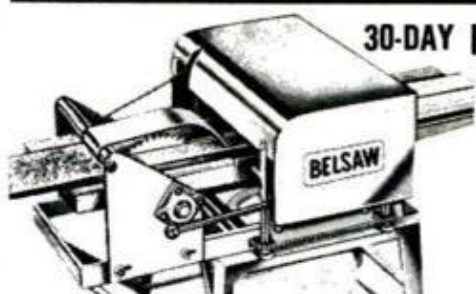
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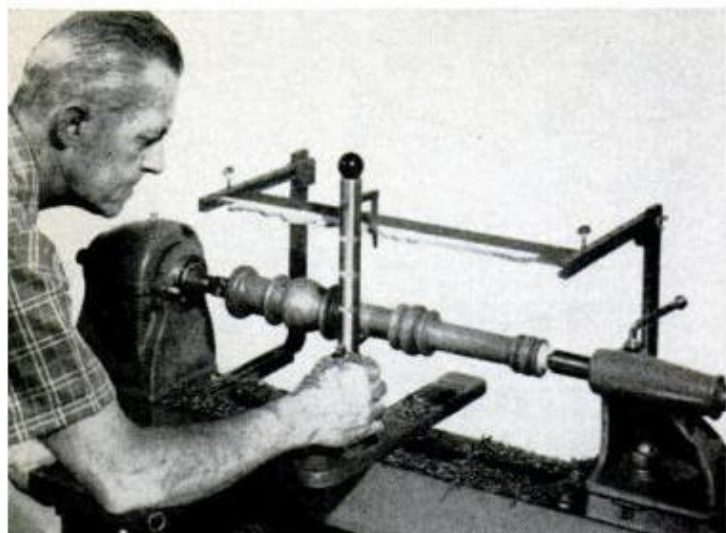
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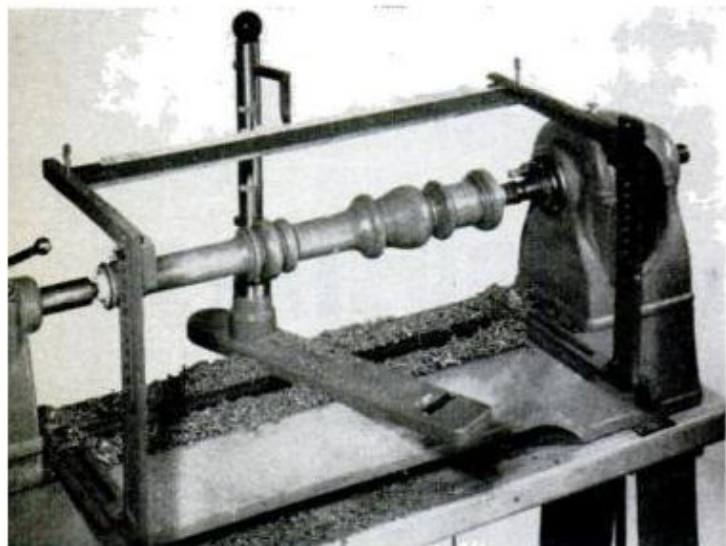
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Lathe Attachment Duplicates Woodturnings



TOOLPOST TRACER follows shape of template, producing its identical profile in a wood turning



TEMPLATE-HOLDING BRACKETS are clamped to lathe; toolpost is guided freehand along the bed

EVEN IF YOU ARE an old hand at woodturning, it's almost impossible to turn four table legs or a dozen chair spindles exactly alike; you can come close but you just can't turn each and every one of them identically, free hand.

Let me tell you about a lathe attachment I just tried which makes turning duplicate pieces ridiculously simple. It's called an A-Base Duplicator and with it you can turn out "carbon copies" almost with your eyes closed. It consists of two template-holding brackets which clamp to the lathe bed and a combination toolpost-and-tracer which rides free on top of the bed.

To use it you first jigsaw a master profile template of the leg or spindle from 1/4-in. Masonite (or you can use an original turning) and mount it between the brackets so the centerline of the template and the centerline of the lathe are in direct alignment. Then with the blank between centers and your lathe running, the combination toolpost-and-tracer is placed on the lathe bed and moved by hand along the spinning work. As the turning takes shape, the tracer follows the profile of the template and guides the cutter. The finished turning is an exact duplicate and you can make as many more as you like.

The attachment will fit any lathe with a 6 to 12-in. swing. When ordering the attachment, you must include the name of your lathe and the distance from the top of the lathe bed to the center of the headstock spindle. It sells for \$59.50 f.o.b. from Turn-O-Carve Co., 3680 University Ave., San Diego, Calif. 92104.—*Wayne C. Leckey, Home and Shop Editor*

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RV COLD-WEATHER TIPS

(Continued from page 153)

surprising increase in interior warmth.

Heavy clothing is always taken on cold-weather trips, but many beginners fail to select the right *sleeping gear*. Ordinary blankets are nearly worthless for sleeping under subzero conditions, even inside an RV. Blankets do not create heat, as many persons believe; they can only trap and retain body heat—with less efficiency than a sleeping bag. A five-pound filled bag is best. I prefer a six-pound bag, myself; in a pinch I can throw a heavy blanket over my feet. Remember, no winter trip is worth an inadequate night's sleep due to the cold.

The practice of peeling off clothing to get into bed is unwise on subzero nights. Remove only your shoes, or else sleep in insulated underwear (long johns). Pajamas are excess gear, and getting into and out of them causes body-heat loss at the worst possible moments in the morning and evening. Cold feet can be avoided by wearing heavy socks in bed. Mountain climbers do it.

Avoid tracking mud, snow or ice into the coach. Place a few boards at the doorstep to clean boots before entering. A piece of old carpet is excellent, too. I usually carry a foot-long piece of four-inch angle iron and place it alongside the entry step. As passengers enter, they can scrape off their boots on the upturned iron. A small, stiff broom also helps.

Packing an extra portable heater is not the best way to go cold-weather camping. Until every source of heat loss is eliminated and each passenger learns to dress properly, adding more heat will only aggravate discomfort. Your coach will have a hot, stuffy headspace and a chilly floor. If it's properly insulated and you're still cold, consider a larger furnace. The best and safest heaters draw in fresh air from outside for combustion and exhaust all burned gases outside.

Be sure to avoid the three deadly sins of cold-weather heating:

- *Never use charcoal to heat a tightly sealed camper or trailer.* The fumes are lethal.
- *Never operate an open range burner or propane lamp in a closed coach.* Suffocation is possible. Always leave a window or vent open an inch or two to provide fresh air.
- *Shut off all interior gas valves when a propane tank runs dry—immediately.* Then, when you connect your next full tank of propane, you won't accidentally attach it to open lines inviting an explosive situation! ★★ ★

INSTALL A THREE-WAY SWITCH

(Continued from page 186)

duplex outlet that has been rewired to provide three-way switching at the lower outlet. The circuit also demonstrates how to introduce power at the common terminals of the switches instead of at the paired terminals.

Pilot lights are useful when one switch is remote from the lighted area. One type of three-way switch contains a neon bulb in the toggle. It glows when the lighting is OFF, and goes out when either switch turns the lighting ON. This gives a negative signal to inform an observer.

A more satisfactory layout is obtained by purchasing a three-way switch and pilot light combination, or by mounting a pilot light adjacent to a standard switch. The combination housing contains light and switch in a manner that can be protected by a cover plate for a duplex outlet. This or the separate pilot requires a fourth wire (or three wires plus a common neutral). A typical circuit is shown in diagram C, page 186.

Fishing a wire through a wall can be done by several means. Handiest among tools is a small link-type chain. It is an excellent leader from an upper opening to a lower one because it falls by its own weight, passes easily through small holes, slides readily over timbers, is easily dislodged from snags and is strong enough to pull a balky cable. It can also be lowered into a wall and readily "fished" by a stiff wire bearing a small hook.

If chain is not available, a strong, waxed cord will do quite well. But for most jobs it will be necessary to weight one end with a large nail, drill bit or a length of solder.

In some cases it will be possible to pull a new three-wire cable into a wall by using the older two-wire cable that is being removed. However, this can be frustrating. Properly installed cables are anchored with large staples near every switch or junction box, and may follow such a crooked path that they cannot be pulled out. While they were easily installed when the wall was being built, it may be impossible to replace them without opening up the wall. Usually it is more practical to employ a method for using the existing wires as shown in the left-hand drawing on page 183.

Youngsters are often helpful at finding the concealed end of a new cable or lead-in chain. Their small hands and agile arms slip readily into holes only large enough for switch boxes—and into other openings too small for Dad's brawny biceps. ★★ ★

DISASTER AT HURRICANE CREEK

(Continued from page 89)

a.m. They began loading coal, while preparations for blasting went ahead.

Walter Bentley, 60, had a reputation for being a good man with explosives. But his principal experience had been in road construction work. The week before he had blasted a recess about 10 by 24 feet to make room for the headpiece of the conveyor. The last part of the job was to carve out another section 18 by 28 feet and 30 inches deep to hold the conveyor tail section and the two feeders that would load it with coal.

Shot holes had already been drilled for the explosives—perhaps as many as 120 of them despite the fact that safety regulations state that only 20 shots can be fired simultaneously—and Bentley went busily about his job.

He stuffed sticks of explosives into the holes and then wedged them with bits of

Debris was flying from all of the eight openings to the mine.

wadded paper and brattice cloth (the cloth used to make ventilation curtains to direct the airflow). There is some question about the exact explosive employed. Dynamite is strictly forbidden underground because its flames travel outward when it explodes, and it can set off coal dust or methane. Primacord, used to detonate dynamite on the surface, is illegal for the same reason.

Walter Bentley—it was later discovered—apparently used both. His last act before he died was to touch the ends of a blasting cable to the connections of a nearby battery-powered trailer.

All might have gone as expected had it not been for the large amount of coal dust swirling through the mine. Regular applications of rock dust would have held it down; but rock dust was used infrequently and in small quantities. The explosive Primacord and a huge charge of dynamite flamed out, found the coal dust and set off an explosion that reached into every corner of the mine.

Mine operator Charles Finley—in his office-trailer outside the mine when the explosion occurred—remembers only that he “heard something like a windstorm.” Debris was flying from all of the eight openings to the mine. The two large ventilating fans were still operating, but now dense black smoke was being pulled through them, and the air was heavy with the smell

of burning. After the smoke subsided, frenzied efforts were made to get air down to the work area. Rescuers placed brattice cloths and sacks over the openings to get air back to the men. But it was too late.

A total of 38 men died, most quickly but some only after painful attempts to breathe the poisoned atmosphere. Thirty-four widows and 103 children would mourn the loss of those who had died in a hole in the earth that was supposed to be safe, a coal mine subject to the new mine safety law and inspections by state and federal authorities.

Miraculously spared, A. T. Collins staggered up from the roadway, tried to help, and was suddenly aware that he was injured. “A supply salesman was there,” he recalls, “and he poured something in my eyes to wash them out.” Another man was also present, and the two gave him what first aid they could. A short time later, as the shock wore off, Collins’s back began to hurt. An ambulance was summoned to take him to the hospital where he would spend the next two weeks. He was the sole survivor.

Rescue efforts got underway by mid-afternoon, and the first bodies were brought out by dark. The families of the miners gathered around the entrances, hoping against hope their men would be found alive. Gordon Couch, a federal mine inspector, found the first body; it proved to be that of his uncle. Miner Shelby Hacker, also on the first rescue team, helped carry out two cousins and an uncle.

Had the 38 died instantly from the explosion or had some survived only to be asphyxiated by carbon monoxide? Collins and others believe they died instantly, but examinations conducted by Dr. William Beasley in the temporary morgue erected in the Hyden Elementary School tell a different story.

Beasley’s findings show that 31 or 32 of the miners died from the blast—the high-velocity shock wave. In five other cases, the skin had turned a distinctive red, a sign of carbon monoxide poisoning. In a final case, a soaking wet miner’s body was brought in. Dr. Beasley applied pressure to the chest. Water came from the nose and mouth. Had the victim found water to shelter him from the heat and then drowned in it after breathing carbon monoxide? No one could say for sure.

Findings of the Hyden mine disaster point to a nearly absolute failure to enforce the new safety law. Investigators found telltale traces of dynamite and Primacord in the mine. A tiny bit of the explosive remained undetonated in a shot hole in No. 15, and more was found stored

(Please turn to page 202)

DISASTER AT HURRICANE CREEK

(Continued from page 201)

on the surface. Two spools and short pieces of Primacord were found near the ill-fated boom hole in No. 16 mine.

The record of inspections is even more damning, however. Potentially disastrous conditions had been found repeatedly and deadlines were set for cleaning them up. Safety recommendations which might have saved 38 lives on that Dec. 30 were ignored or indifferently complied with. Though they had the power to close the mine until it was made safe, state and federal agencies failed to do so.

● *April 16, 1970*—The first state inspection took place well after the mine was producing coal, uncovering seven serious violations. Mine timbers needed to hold up the roof were simply lying in the roadway, and rock dust—needed to keep down the explosive coal dust—was not being applied.

● *June 19*—Although federal investigators failed to make a complete inspection at any time, a partial one revealed that only nine self-rescuers—small gas masks needed to filter out gases after an explosion—were available for 39 men. When the explosion occurred, there were only 21 masks—stored 400 feet from the main working area. Ironically, the report also notes dangerous coal dust. And once again, rock dust was not being used.

● *Aug. 12*—Rufus Whitehead and Mack Collins were injured. The federal inspectors who looked into the accident pointed out that explosives should be handled only by approved means, and that coal dust and other combustible materials should be cleaned from equipment.

● *Aug. 20*—A second state inspection showed that safety recommendations were being ignored. Loose, explosive dust was accumulating—and the rock dusting needed to counter it was haphazard and insufficient. Among the 17 serious violations of the law was the fact that explosives were improperly handled.

● *Nov. 9*—The death of Charlie Wagers brought federal inspectors back. Better maintenance was recommended along with closer and more strict supervision.

● *Nov. 19*—A spot inspection found high concentrations of respirable coal dust. Self-rescue devices were not provided for miners underground . . .

On Dec. 30 and the days that followed, the last remaining duty was to mourn the dead. "Once every three or four days, a man dies in a coal mine, somewhere in the United States," wrote researcher Thomas N. Bethell in a report for the Coal Miners Legal Defense Fund. His words were later

reprinted in *The Congressional Record* and in book form, and they provide a moving epitaph:

They bring his body out of the mine and send it away to the funeral home, and his family comes and pays for an elaborate casket; they will be making time payments on the casket for years to come. The miner is buried, and his wife and children go on welfare, at least until the workmen's compensation payments begin, and then they can look forward to the check every week—\$48 in a state like Kentucky—and at night when they hear the diesel horns coming up the valley, and watch the C&O or the L&N or the N&W or the Clinchfield Railroad carrying the coal away to American Electric Power's plants or to TVA or Detroit Edison, they can remember what it was like before he died, when he came home at night tired and black with coal; they can remember him as a coal miner, and mainly they can remember him as a human being. ★★

DO YOUR OWN AUTO TOUCH-UP

(Continued from page 194)

have a spare fender for practice, try a tin can with the label off. Hold the spray can 10 to 12 in. from the surface and spray with fast smooth strokes. Don't stop during the spray; keep moving. Do not apply heavy coats; they'll run or sag. Apply several thin coats and wait 30 to 60 seconds between coats. The spray coat should be thin but glossy. When you think you have the hang of it, switch to the car.

You probably know that spray paint has to be mixed by shaking the can vigorously. This is most important. You should shake the can for a full minute before you start and occasionally while spraying.

To touch up a small scratch or nick, try this: Cut a small hole, similar in size and shape to the scar, in a piece of cardboard. Hold the cardboard shield an inch or two from the scar and spray through the hole.

● As a final step you will want to spray a very light coat of leveler over the fresh paint to blend it into the surrounding area. This must be no more than a mist coat.

You can omit the leveling coat if not sure of yourself and use rubbing compound to blend in the patch and remove overspray. Let the paint dry hard at least a week before you rub it and use plenty of clean water with the compound. Rub lightly so you don't cut through the finish.

A good rule to follow when you are through spraying, is to hold the can upside down and spray a jet of clear gas. This will clean the valve, and the can will be ready to go next time you need it. ★★

DISNEY WORLD OF TOMORROW

(Continued from page 99)

area with space for over 1000 campsites, hiking and bridle paths through partial wilderness, tennis and shuffleboard courts—will occupy in all only 2500 acres. An additional 3000 acres has been incorporated as the city of Lake Buena Vista, a recreational community of "second homes" being built around a golf course and along creeks and parkland. Four sizable motels are under construction here; eventually the town will hold 7000 to 8000 people.

Except for the conservation area, much of the remaining acreage is being held for future development. Disney planners speak of the present as "Phase I"; "Phase II" will come in six or seven years and "Phase III" at a time not yet revealed.

A highlight of Phase II will be a futuristic city of 20,000 inhabitants known as EPCOT—Experimental Prototype Community of Tomorrow—to be built inside Walt Disney World on a site already selected. As envisioned today, it will be in the shape of a wheel, with a high-rise business district at the hub and transportation lines forming the spokes and rim.

A complete city open to all, not just for Disney employees, it will have churches and schools and businesses and homes. Next door will be an airport and a 1000-acre industrial park.

Here, new equipment and techniques—developed by firms such as U.S. Steel, Monsanto, Aerojet General and RCA—will be used. Disney World is to act as a testing ground for EPCOT, just as EPCOT is to be a testing ground and example for modern communities everywhere.

Thus, like today's amusement park, the EPCOT business district will be multilayered, with the top layer reserved for pedestrians and service traffic in "Utilidors" below. Trash will zip beneath the streets in pneumatic tubes. Monorail trains like those vacationers now ride will whisk EPCOT commuters to work and home again, with connecting service provided by something like the WEDWAY People Mover. This intermediate-speed (5 to 10 mph) system, now in use in Disneyland, has vehicles that are propelled by stationary motors on trackways.

Various other startling concepts for EPCOT are on the drawing boards or aborning in the minds of Disney planners and of researchers for cooperating firms. EPCOT, in the words of Walt Disney, "will always be in a state of becoming . . . a living blueprint of the future." As in Walt Disney World itself, there will always be something new and worthwhile to see. ★★★

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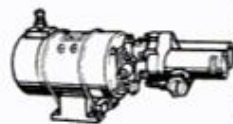
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IT TELLS A 747 WHERE TO GO!

(Continued from page 111)

at which time the autopilot is selected to INS mode. The Carousel IV then guides the aircraft from waypoint to waypoint to destination without further crew attention. Instantly available on the cockpit display panel are ground speed, wind direction and velocity, present position, heading and drift data and the distance and time to the next waypoint (or to the destination, point of departure or any other waypoint, for that matter). Should a diversion to another route or destination be required, it is a simple matter to insert new coordinates.

The INS takes its own pulse continuously and reports its state of health. Should it receive insufficient electrical power or overheat, it will shut down and turn on a warning signal. Less critical malfunctions are reported in number codes: one of 68 numbers pinpoints the problem, and one of five other numbers directs the action to be taken.

Federal regulations require that two complete and independently operating systems be aboard flights using the INS and these are as standard on the 747 as windshield wipers on a car. Most airlines carry a third operating INS, using it as a "hot spare" rather than storing replacement units at each 747 station. Should a set fail, a trip can legally depart with the remaining two.

During the FAA certification tests of the Carousel IV aboard three Boeing 707s in 1969, the system proved so accurate and dependable that operators are not required to back it up with radio or celestial means of checking position.

Finnair was the first airline to use Carousel IV as its primary navigation reference. In late 1969 it operated an INS trip nonstop from Helsinki to New York with stops at Copenhagen and Amsterdam using DC-8 equipment. During the 3200-mile overwater leg, the flight encountered crosswinds of 120 knots, yet the INS maintained a near-perfect track. Upon arrival at New York after nine hours of flight, the three INS sets showed errors of .002 to .005 percent, well within Finnish and American specifications.

So the day is finally at hand when the airplane will be able to fly to anywhere in a truly straight line, with all benefits that will entail for the airlines and their customers. Since an entire INS system—navigation unit, mode selector, control and display unit and battery—weighs but 74 pounds, this space-age marvel is entirely suitable for small private aircraft. Delco Electronics has them for sale at about \$100,000 each! (Installation extra.) ★★★

INSTALL A WASTE DISPOSER

(Continued from page 170)

and later replaced. Then place plumber's putty under the sink flange to prevent leaking, tighten screws evenly from below and trim away excess putty. (If the flanged drain elbow is not already attached to the disposer when you get it, attach it and the rubber gasket with two hex-head bolts furnished.)

You're now ready to lift and attach the disposer to the mounting ring. Holes in a mating ring at the top of the disposer are aligned with the slotted screws and hex nuts are applied and tightened with an open-end wrench. It might help to support the heavy disposer (if you have room) with a 2x4 prop until the three nuts are in place. Elongated holes in the ring let you turn the disposer slightly to align the drain elbow with the waste pipe.

With the disposer mounted you can determine the length of the new nipple needed. Where the disposer center might not be in direct line with the waste pipe, you may have to swing the disposer for joining the trap. Examples of offset waste pipes are shown in the drawings on page 170. Note that the P-trap is positioned accordingly. Steel pipe nipples (1½ in. o.d.) come in 2, 3, 4, 6, 8, 10 and 12-in. lengths. You should be able to reuse the original P-trap and elbow; you need only replace the nipple. When screwing the latter in the drain fitting, coat the threads with joint compound and turn the pipe as tightly as you can with your pipe wrench. Add the elbow to the outer end and finally remount the P-trap.

Since it is difficult to determine the exact length of pipe nipple your installation will require, it will pay to have several different lengths on hand. Nipples you don't use can be returned.

To wire the disposer, just run a length of BX cable from a nearby 110-v. outlet box to an access plate on the bottom of the disposer for hookup to the disposer wires. If you have a continuous-feed disposer, you will have to locate a separate wall switch near the sink and wire it into the line.

Naturally, plumbing and electrical connections should conform to local codes. If you have a septic tank, the U.S. Public Health Service advises that you can safely use a waste disposer if your septic system meets the following standards:

House occupants	Minimum Tank Capacity
4	750 gallons
6	900 gallons
8	1000 gallons
10	1250 gallons

A disposer will not cause the absorption field of a septic system to flood. ★★★

HOW TO DOUBLE TIRE LIFE

(Continued from page 161)

easier by the use of special tools. One of these tools, a tire bead breaker (a "must"), costs about \$25. Tire irons shouldn't be used in place of a bead breaker. They can damage the bead and ruin a tire.

Although do-it-yourself repair isn't practical, there are some things about it that you should be aware of. First of all, have permanent repairs made. These include a cold plug and patch repair or a chemical and hot vulcanized patch repair. Permanent repairs are made from inside the tire only. Repairs made from the outside of a tire are not permanent—they will leak after a time. However, one kind of temporary repair is useful. This is the aerosol-type sealer, which can be used in an emergency until a permanent repair can be made. During such use, you should not exceed a speed of 50 mph or a distance of 100 miles.

If you decide to make tire repairs yourself, there is a very important caution to keep in mind. When reinflating a tire, be careful: Do not stand over it and do not put more than 40 pounds of pressure into the tire.

Here are additional tips about tires you may find useful:

- *Dirt on red or white sidewalls* may be sponged off with clear water and soap. However, a good brand of whitewall tire cleaner is more effective and will remove stains and discoloration where soap and water won't. Under no circumstances should you use gasoline, kerosene or any cleaning fluid with an oil solvent. Oil in any form is detrimental to rubber.

- *If you're buying new tires*, keep in mind that belted tires shouldn't be mixed with conventional tires.

- *Never buy a smaller-size tire* than those which originally came with the car. Tires should always be replaced with the same size designation or an option that has the approval of the car's manufacturer. See your owner's manual or check with a dealer.

- *If you're buying just two new tires*, place them on the rear wheels for better traction and handling. A single new tire should be paired on the rear with the tire among the others that has the most tread depth.

- *If you plan to equip your car with radials*, you will have to buy five. You shouldn't mix radials with any other kind. The car will be unstable if you do.

- *All new tires should have a break-in period* to allow elements to adjust gradually to each other. Limit speeds for the first 50 miles of driving to 60 mph. ★★

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AMC GETS IT ALL TOGETHER

(Continued from page 118)

changes in grille, taillights and exterior trim to distinguish the '72 from the '71. But nothing that'll shake you up.

Comes in three body styles, two-door hardtop, four-door hardtop and a wagon. Two series, the SST and the Brougham. **MATADOR:** Minor changes in grille and ornamentation. You can now get a rear sway bar as a separate option. You used to have to buy a package of extras to get it. Another option: ventilated-rotor front disc brakes, manual or power. But the manual version comes only on six-cylinder sedans and hardtops without air-conditioning.

Three models—a four-door sedan, two-door hardtop and a wagon. The wagon has the larger 20-gallon gas tank, same as Ambassador.

HORNET: This one's been trimmed down from a six-car line to three models for '72. There's a two-door sedan, four-door sedan and Sportabout sedan/wagon.

But you can still roll your own on Hornet and order a special package if you don't like the factory ready-mades. An "X" package is available for the two-door and Sportabout. It includes slot wheels, C78X14 black tires, a special steering wheel and exterior trim. With the two-door package you get rally stripes on the sides at bumper height. On the Sportabout the stripes run from the upper front fenders through the upper portion of the doors, below the rear side glass and curve up to follow the rear angle of the windows. Another trim package, dubbed the "D/L," for Sportabout has been carried over from last year. With this one you get woodgrain side and rear panels and some show-off wheel covers. In mid-October, a special fashion-oriented "Gucci" Sportabout will be in showrooms. Named for its creator, Dr. Aldo Gucci, the Italian designer, it will feature a bold interior, special colors and other appointments.

Ball-and-socket air outlets in a package tray have been added to the air conditioner. An adjustable, tiltable steering column is a new option if you take the automatic transmission. The headliner on sedans is made of fiber-foam material instead of fiberglass.

On both Hornet and Gremlin, the windshield cowl section has been redesigned and sealed hermetically. This makes for a tighter fit of the glass and eliminates the possibility of water leaks.

GREMLIN: One of the beefs made by people smitten with the size and shape of AMC's mini has been the lack of a V8. Well, fault 'em no more on that score. You

BONUS FOR CAR BUYERS

At PM press time, American Motors announced its Buyer Protection Plan for buyers of 1972 models. AMC car owners are promised a 12-month or 12,000-mile warranty on all parts and labor on anything that goes wrong; repair in one day or free use of a loaner car; pre-delivery road test. This will ensure owners "a full year of 12,000 miles of trouble-free ownership," says the company.

can now get a 304-c.i.d. V8, the same plant that's standard on Ambassador.

Gremlin's down to a single car for the new model year, a two-door, four-passenger job. It has a fixed rear seat and a sealed-in rear window. The two-passenger Gremlin has been discontinued.

If you pop for a deluxe package, you get fold-down rear seats and a swing-out rear window. You can special order a flip-open rear side window.

AMC's offering nearly all the options on Gremlin this year. Things you couldn't get last year. The list includes manual or power front discs, adjustable steering column, AM/FM pushbutton radio and an inside hood release lock. Rally stripes too.

JAVELIN: Two two-doors, the SST and the AMX. The grille's new and you can change the appearance of the SST still more by paying extra for rally stripes. There's a wider assortment of colors than for any other AMC car. Fifteen choices.

The company says a new no-lash ball joint for front suspension upper pivot makes for quieter, smoother operation and requires less servicing. The one-piece ball-stud is stronger, seals tighter and retains tolerance longer. ★★

CHRYSLER SETS STANDARDS

(Continued from page 126)

els for '72, against 94 offerings last year. Chrysler-Plymouth dropped 14 cars. Dodge chopped seven. And, alas, the little Simca (which Chrysler ought to have bragged about more) will no longer be imported from France.

Looking at 'em alphabetically, here are the highlights:

BARRACUDA (Plymouth): Two models, both two-door hardtops. The standard car comes with a 318-c.i.d. six, the 'Cuda (deluxe version) with a 340-c.i.d., four-barrel V8. The new options: an electrically operated sun roof and a sport dress-up package. There's also a new vinyl roof material containing reflective particles. But you have to take it in blue. Chrysler's

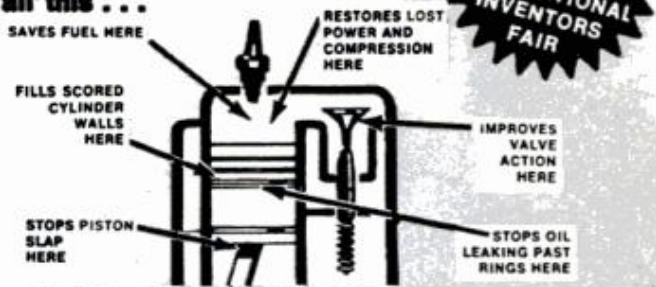
(Please turn to page 208)

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. . . The activation of the Motaloy and the subsequent tracing operations of the activated Motaloy was conducted by an independent research laboratory especially licensed by the Atomic Energy Commission to supervise the industrial application of radioactive isotopes.

Approximate Amounts of Activated Motaloy Deposited on the Surfaces (after approx. 60 hours of operation)

Piston Rings	Light
Piston	Light
Cylinder Walls	Light
Intake Valve Face	Very Heavy
Exhaust Valve Face	Heavy
Intake Valve Seat	Heavy
Exhaust Valve Seat	Medium

The above tracing of the radioactive Motaloy is positive proof of the actual transfer of the Motaloy particles from the gasoline tank on to the surfaces of the above surveyed parts of the engine.

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*Gold Medal, Naples, Bronze Medal, Brussels, 1964.

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"About 5 years ago I put Motaloy-tablets in my Cadillac. I drove this car 125,000 miles and it never used any oil between changes — 1,500-2,000 miles!"

V.F.G., Cincinnati, Ohio

"My Chevrolet had 49,000 miles on it. It had noisy valves and other troubles. Motaloy corrected all this. It is running better than new."

L.F.M., Waterboro, S.C.

"After using Motaloy in my Chevrolet my compression increased an average of 3 1/2 pounds per cylinder, which to me is conclusive proof that Motaloy will do everything that is claimed for it."

W.P.C., Elkview, West Va.

"My Dodge used one quart of oil every 225 miles. After using Motaloy I drove 1,245 miles and did not have to add any oil."

G.W., Cincinnati, Ohio

"Since adding Motaloy I have driven more than 1,500 miles, and I must say that I am amazed about the wonderful results. My gas consumption improved 40%, and my oil consumption is practically nil."

W.G.K., Fort Atkinson, Wash.

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W.A.C., Granite City, Ill.

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E.H., New Plymouth, Idaho

"As instructor of the Automotive Shop I have been running a series of tests on your product 'Motaloy' and I wish to take this opportunity to report to you our findings. I put Motaloy in some 35 vehicles and have obtained marvelous results. In a majority of cases (all except 2 cars with burned valves beyond repair and/or broken oil and compression rings) the compression was brought up to factory specifications, oil consumption greatly reduced and gas mileage increased."

B.L.H., Instructor Automobile Shop, San Antonio, Texas

"We have sold Motaloy for nearly 8 years and have yet to have a dissatisfied customer. A good number of those who purchase buy again when they change cars. Many refer their friends to us when they see the results Motaloy gets in their own cars . . . a good job in increasing the efficiency and operation of their engine."

E.W., Service Owner, Texas

CHRYSLER SETS STANDARDS

(Continued from page 206)

done a good job of eliminating knobs and projections in the passenger compartment that could cause injury in an accident.

CHALLENGER (Dodge): Two hardtops. New grille and taillamp treatments. You can get a sun roof and there's a "Rallye Package" of visual add-ons if you want to give it more flash. The division's made some modifications in its engines to improve cold-weather performance and operation with low-lead or no-lead gas.

CHARGER/CORONET (Dodge): These are the Dodge intermediates. Charger comes in a two-door sport coupe and two-door hardtop. Coronet's available in two four-door sedans and a wagon. Handling and brakes have been improved. Charger 500 and Charger SE (for Special Edition) will be lower priced than last year. You'll have to check with your local dealer to see how much lower, because price information wasn't available when this section went to press.

CHRYSLER: Royal, Newport and New Yorker come in two-door and four-door hardtops and four-door sedans: your choice. There's also a Town and Country wagon, two-seat or three-seat. New sheet metal and new rooflines on everything except the four-door sedan and wagon. The tailgate door on wagons can be opened without rolling down the window. The door locks automatically when the ignition is turned on. Newport Custom and the wagon have the company's new 400-c.i.d. V8 as standard equipment.

COLT (Dodge import from Japan): Chrysler's been making running changes in this car. Self-adjusting rear brakes and larger front discs will be added during the '72 model year. There's a molded carpet coming and two new colors. You can have it in four models—coupe, two-door hardtop, four-door sedan or four-door wagon. The division expects to sell twice as many Colts in '72 as it sold in '71.

CRICKET (Plymouth import from England): An optional dual carb has been added. It puts out an additional 15 hp for a total of 85 horses. Automatic choke has been made standard, except on the twin-carb version. An idea we liked on the car we tested is a seat-release latch that can be operated with one hand or the toe of your shoe. By pressing the lever up, the seat flips forward, giving access to the back. Cricket comes in one body style—a four-door sedan. There are five new body colors for '72.

DART/DEMON (Dodge): Six models, two-doors and four-doors. Better brakes, the column-mounted manual shift uses a new torque shaft to reduce shift lever vibration and the automatic transmission is said to be more durable and run quieter. Name emblems are now die cast, replacing the paste-on decals. An inside hood release is a new option for Dart.

FURY (Plymouth): The big Plymouth comes in 16 models this year. There's new metal on the outside, new bumpers, grilles, lamps and trim. Windows work better on two-doors. They aren't as hard to crank up and down and sealing is tighter against water and noise. A polypropylene plastic steering wheel is standard. The wheel has a consistent feel regardless of climatic changes. If it's standard on the regular-size Chevrolet or Ford, it's probably standard on Fury.

IMPERIAL: Chrysler's most expensive car, Imperial LeBaron, comes in a four-door hardtop and two-door hardtop. New sheet metal all around. Fiberglass fender skirts to keep road splash off the steel body panels are standard. The water pump has a rotating ceramic element to reduce service. On the two-door, seat backs unlatch automatically when doors are opened.

MONACO/POLARA (Dodge): Monaco has a new front with concealed headlights and a different bumper to distinguish it from Polara. Both cars are available in two and four-door hardtops, four-door sedans and two-or-three-seat wagons. On the wagons, the tailgate door opens outward, like a door, or it can be lowered flat like a standard tailgate.

SATELLITE (Plymouth): You can have the Plymouth intermediate in a choice of five wagons, four two-doors or two four-doors. There are seven engine choices. The new 400-c.i.d. V8 is standard on Road Runner, optional on other Satellites. The four-barrel version of the engine has a plastic main body to reduce heat transfer to the fuel. All Road Runners now have front and rear sway bars as standard.

VALIANT (Plymouth): In three versions: Valiant, a four-door; Duster, a two-door coupe and Scamp, a two-door hardtop. A manual sliding sun roof is a new option for Duster. Hub caps are made of anodized aluminum to reduce corrosion. There are no more springs or mechanical parts in bucket seats. They're all of full foam construction. Although little changed from last year in appearance, Chrysler looks for the Plymouth compacts to gain—about eight percent—in the new model year. ★★

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GM HOLDS THE LINE

(Continued from page 123)

(to your new Pontiac). Two urethane plastic blocks set into telescoping bumper mounts take the shock, and rubber trim strips front and rear ward off more minor collisions. The urethane blocks rebound and last the life of the car.

Instrument panel serviceability has been improved in big Pontiacs for 1972, and all components can be reached from the front seat. Firebirds haven't come in for much change, but Pontiac officials stress that they have no plans to drop it in 1973 (See *Detroit Listening Post*, page 40).

OLDSMOBILE: All 1972 full-sized Oldsmobiles use a spring-steel-supported front bumper plus heavier gauge metal for the face bar. So in a five-mph car-to-car crash, there's no damage to the '72 Olds front bumper or surrounding sheet metal.

Otherwise, the 1972 Olds series gets minor facelifts and detail improvements. The number of '72 models has been cut from 28 to 25 by deleting the Delta Custom and making the 4-4-2 an option package on Cutlass and Cutlass Supreme coupes and convertible.

Oldsmobile's decklid air exhaust system has been dropped (at great expense) and replaced with a flow-through vent system that now exhausts through the door-lock pillars as in 1970. The 1972 Toronado's front disc brakes have wear indicators that set up shrill scraping noises when the pads become dangerously low. This innovation will spread to other GM makes soon. Another Toronado improvement is a venturi-action fan shroud that helps pump more air through the radiator.

Olds 88s and 98s use a one-piece plastic front end panel. The F-85 gets heavier finned front brake drums to soak up and dissipate heat better. Other Olds improvements include a magnet inside the antispin differential housing to pick out metal particles, a one-piece alternator/regulator for the Toronado, improved engine mounts and better shock absorbers.

BUICK: All Buicks have front and rear rubber bumper strips, and full-sized Buicks use a rigid box-section reinforcement behind the front face plate to give better protection.

An exhaust-gas recirculating system to cut down NO_x emission is used in all Buick 350 and 455 V8s sold in California plus those with manual transmissions. This system uses passages cast into the intake manifold, the idea being to lower combustion temperatures, which in turn cuts the production of NO_x. Buick engines also use an air pump to complete

the burning of hydrocarbons at the exhaust ports.

A solenoid-actuated throttle stop, introduced late last year, closes the carburetor butterfly when the ignition key is turned off. This prevents dieseling—a problem with the lean mixtures and low-octane fuels used to cut emissions.

CADILLAC: In keeping with Cadillac's traditional year-to-year detail refinements, GM's prestige leader puts on a new face but not much more. Headlights are spaced farther apart, with parking lamps in between each dual set. Sturdier bumpers (nongiving) give better low-speed impact protection.

Under the skin, improvements are again minor. The front suspension has been changed to use an integral hub/brake-rotor/spindle assembly. The en-



CADILLAC ELDORADO has all new grille; the flush, hard-plastic boot cover is standard on convertible

gine gets a new choke. And Cad's anti-skid device, available last year only on the fwd Eldorado, is now an across-the-board option. The Eldo convertible, which we predict will become a future classic of the highest order (given 20 years), now has a flush-fitting fiberglass boot over the folded top. ★★★

NEXT MONTH IN PM

Owners Report on the Honda 600

See what the owners say after driving this import some 2,000,000 miles.

300-MPH Monorail

The inventor started with a toy for his kids. He now has what may be the big breakthrough in practical high-speed transportation.

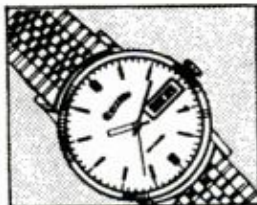
Instant Replay: TV's Electronic Magic

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Ordeal on Beartooth Mountain

The trek was strictly for sport. But when the 16 snowmobilers—including two Minnesota Viking linemen—reached the summit, they were hit by the full fury of a mountain blizzard.

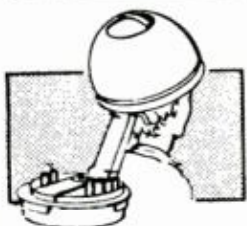
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HOP UP YOUR IGNITION

(Continued from page 131)

coils, that the effective spark voltage is doubled at 10,000 rpm and at half the price of a dual-coil system. The unit can be wired in 30 minutes.

Obviously, solid-state electronics—transistors to the layman—has revolutionized the field of specialized ignition equipment in the last five years. In fact, it promises to revolutionize *factory* ignition systems within five years. In 1975, your stock system won't be anything like it is today.

You can get a preview of some things to come in your bolt-on "capacitor discharge" conversions from the current hot-rod market. I'm sure you've all heard this term. Experimental CD ignition systems have been around in laboratories for 20 years. But bulky vacuum tubes were used. Not until the low-priced commercial transistor became available was CD ignition practical for cars.

. . . the engine . . . with CD ignition, just blasts those sparks, plugs fouled or not.

Very simply, the principle is to build up your coil's primary voltage by letting the battery current charge a condenser or "capacitor" through an oscillator circuit, and then suddenly discharging the condenser into the coil—something like blowing up a balloon and then puncturing it. You get a tremendous surge of electrical energy into the coil primary—three or four times the voltage that the battery could give directly. Furthermore the "rise time" of the secondary voltage to the sparkplug is much quicker, like 3 or 4 millionths of a second, or maybe $\frac{1}{50}$ th of the normal rise time. This blasts the spark across the gap in the cylinder before it has time to leak away through oil or lead deposits on the electrodes.

So the basic concept of CD ignition actually has *two* important advantages: One, the higher voltage and energy fed into the coil primary circuit gives that much higher secondary output at the plug, up to 50,000 volts, and you don't have the rapid drop-off in spark intensity at high speeds. But probably even more important, the quick rise time lets this high energy fire plugs that may be badly fouled with deposits, or have electrodes eroded away to large gaps. In other words, with CD ignition you can run a set of plugs three or four times as long as with conventional

ignition, and still get reliable firing and quick starting. The plugs can be all crudded up, with tips worn away. Still the spark jumps the gap, every time. And when your plugs are fouled up from slow speed stop-and-go driving, and you want to punch it to pass somebody, there's no hesitation or missing.

These bolt-on-wire-in CD conversion units being sold by the specialty companies have another important feature: The transistor circuitry is designed to greatly reduce the battery current that flows through the points when they're closed. They merely act as a trigger to control a larger current in the condenser circuit.

This tiny current that flows through the points means they will last a lot longer without pitting and burning. Point life is really limited only by wear of the rubbing block on the cam, and this wear is very slow after the first few thousand miles. You can run a set of plugs and points up to 50,000 miles!

These CD conversion kits come in a small black box, usually finned to dissipate heat, that contains all the circuitry and can be bolted in the engine compartment and wired into the stock ignition system in 30 minutes. Prices run generally from \$35 to \$70. The big names are well known: Cragar, Mallory, Grant, Motion Performance, ARE, Sydmur, Automark and others. The conversions are especially practical where you have a highly-tuned performance engine that must be driven a lot in slow city traffic. Such an engine usually runs rich fuel mixtures with high-overlap cams, and the plugs tend to foul up fast at slow speed. Then when you punch it the engine bogs and misses. With CD ignition it just blasts those sparks, plugs fouled or not! Guys who have once used CD ignition don't want to be without it after that.

The next goal of the specialty ignition people is to get rid of breaker points altogether. This is easier than it sounds. A few years ago GM's Delco-Remy Div. offered an optional CD system using a special distributor with an eight-spoke magnetic ring that rotated past a stationary pickup head to trigger the spark for each cylinder. There were no conventional points and nothing to wear out because nothing touched. In conjunction with CD booster for the spark, it was coming pretty close to a true "lifetime" ignition system. Unfortunately the option was never very popular at a \$100 price, and it was dropped after two years.

However, in just the past few months, both GM and Chrysler have jumped back

(Please turn to page 214)

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HOP UP YOUR IGNITION

(Continued from page 212)

into the picture by coming out with new integral ignition systems based on breakerless magnetic distributors and CD boosters. These will be fairly widely available on 1972 models, and I suspect we'll see a strong trend in this direction in the next few years, especially if factories have to guarantee low exhaust emissions for 50,000 miles with minimum owner maintenance.

Meanwhile the hot-rod industry has been doing some work in this area. A few years ago Mallory introduced a radical distributor that used a light beam and photocell to trigger the spark from a CD booster, without regular breaker points. More recently, Spalding Products of Monrovia, Calif., brought out its similar, exotic BDI system. Both systems are designed primarily for competition engines, and their price of well over \$100 takes them right out of the mass bolt-on market.

Look for a flood of new hot-rod-industry developments in breakerless distributors in the next few years. By the time Detroit gets away from breaker points you can bet California will have something a lot better!

Modifying the spark advance curve is different than hopping up the ignition voltage, but it has just as much effect on the performance of the engine. Standard factory advance curves have to be a compromise to allow for poor gas and carbon buildup in the cylinders. Most cars can be given extra pep at low and medium speeds by advancing the spark a little faster at the low end of the range. Where the factory curve might start out at 6° advance at idle speed and increase to 35° at 4000 rpm (wide open throttle), a curve giving maybe 12° "initial" and 38° at 2500 rpm would make the car more responsive—but with serious knock if everything weren't right.

Special high-performance distributors usually have this "fast" advance curve built in. Often you can readily adjust the curve over a broad range to tune with your engine. Speed experts can pull a distributor out of a car, mount it on a test machine, and get any curve they want in a few minutes by fiddling with the advance stops and weight springs. If you can't do this, the hot-rod shops sell little kits equipped with the necessary springs, stop pins and weights that you can slip into your stock distributor to modify the curve.

Quite a few ways to hop up ignition; take your pick! ★★



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DAN GURNEY ON SNOWMOBILES

(Continued from page 150)

—then motorcycle experience certainly helps. Maybe even a little boating experience, too. Snowmobiling is sometimes a little like being on water."

"I suppose snowmobiling over a frozen lake is a little like iceboating! Has that been the most fun?"

"It's good fun, but I like trailbreaking best. It's wonderful tonic to be out in the woods in the wintertime, discovering animal tracks, wandering through the trees, then breaking out across a meadow. There's nothing like it!"

Suddenly the simultaneous roar of three machines makes further conversation impossible. A neighbor and local guide, George Thompson, opens the kitchen door and waves us outside where the kids are warming up our "horses" for the afternoon trip. We soon have all the snowmobiles running, and Dan Junior lets me share his machine for the run to the lake. Down through the woods and out across the frozen surface—then a quiet visit, interrupted by a snowball fight, before the dash back up the hill to the farmhouse.

Before I left the Gurneys, I asked Dan whether he had any particular advice for first-timers:

"Yes, dress properly. Snowmobiling's no fun in wet clothes. When we first arrived, my kids had some California boots which just weren't up to the cold and snow. Then we bought some snowmobile galoshes with felt inner boots, and that's made all the difference.

"The first day or two, a newcomer should try to get the feel of his machine: how to turn and how to throw his weight around. Different kinds of terrain require different positions: sometimes standing, sometimes kneeling. Experiment to find out what's most comfortable. Like anything else you do, it's primarily a matter of gaining confidence and becoming familiar with your equipment." ★★★

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Hello, my name is Norris Strauss... and I've got to get something off my chest before I explode!

You may think I'm a big shot for putting a full page ad in Popular Mechanics Magazine. Actually I just work at a regular job which I enjoy. I was born and raised in Brooklyn as were my parents—I have many relatives here. I've only moved once in 28 years.

I'm not a racetrack character, nor am I fronting for anybody. Instead of a yacht, sports car and six figure bank account as system writers boast, I drive an ordinary klunker and live in a modest apt. (my family says it's too modest). But I have plenty of leisure and a local rep as a studious neighbor who burns the midnight oil. I was always fascinated by serious research on old Racing Forms to see what I could come up with... well, after many disappointments, I finally found the pot of gold.

I've hit onto something so royally big that I feel like the Chinese with a tiger by the tail, and it's driving me nuts! I went into a spin and ordered a whole stack of back issue Racing Forms, and I found a winning secret that WORKS, period. I can't express the joy of this achievement, nor the sense of power or well being—I feel SECURE.

If I didn't expect a nice pension—I plan to pull a slow one and live to 100, didn't enjoy my job, didn't have ample leisure, if my family wouldn't give me a hard time, if I weren't so darn timid, if my religious parents weren't so anti-gambling, I'd follow the sun from track to track. I've figured I can win over \$11,000 a year on \$20 bets, and that's more than I earn. What to do? What to do?

I need advice. How can I convince people? I've got the races beat out of the frame and I just can't keep it to myself or I'll burst at the seams!

Maybe I shouldn't bring this up, as I have no proof and won't mention names. But something is odd—these horses are winning when they "shouldn't." If I've cracked a code involving track management, publishers or horsemen, or any related combination thereof, I'm ecstatic. If some group is making money on these winners, well—

I checked this method on old Racing Forms for the following periods: Nov. 65 through Apr. 66; Aug. 67 through 68; Jan. 69 through Sept. 69. All periods proved very profitable. Tightening the rules might improve it, but it looks great as is. Were these just lucky periods?

The system selects about 4½ plays per day per track, so you can see this gets plenty of action. Past results have shown that you can expect to make about \$962 profit on \$20 win bets per month at one track. Winners will average about 30% with an average win mutual of about \$9.55.

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ing the horses at the legal bookies in Vegas or Caliente? No job worries, no boss, sleep late, plenty of money—but most important of all, living the kind of life so few people are ever able to.

One last word. You've seen system sellers using aliases from p.o. boxes and mail drops. Has any one of them ever signed his real name, given his history, worked for an honest living, stayed put over 60 days, or cared for anything except getting your money? Weigh that.

I can rush my complete secret to you by return mail for \$10. Check me out. Do what I did. Take any back Racing Forms over a reasonable period of time. Apply my system. If you can show me that it doesn't work, I'll NOT ONLY REFUND YOUR \$10 BUT I'LL DOUBLE IT AND SEND YOU \$20. Fair enough?

State of New York
County of Kings OATH

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Norris Strauss
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Frank Gayer
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READ HOW THOSE USING MY SYSTEM ARE MAKING OUT WITH IT

I can't thank you enough for this system. So far all my back checking has proven to be correct. The following results were obtained through diligent checking:

Hollywood Park	July 1 to Aug. 1, 1970	\$1,394 (21 days)
Aqueduct	July 1 to Aug. 1, 1970	\$814 (27 days)
Saratoga	Aug. 3 to Aug. 29, 1970	\$826 (20 days)
Belmont Park	Aug. 31 to Sept. 30, 1970	\$862 (25 days)
Golden Gate	Mar. 27 to April 10, 1971	\$600 (13 days)
Del Mar	July 24 to Aug. 31, 1970	\$4,252 (32 days)
Bowie	Mar. 24 to April 10, 1971	\$930 (15 days)
Santa Anita	Mar. 24 to April 10, 1971	\$1,000 (13 days)
Aqueduct	Mar. 24 to April 10, 1971	\$400 (17 days)
Longacres	May 29 to June 28, 1970	\$2,378 (20 days)
Longacres	Aug. 1 to Sept. 12, 1970	\$1,840 (25 days)

I can just hardly believe it! Thanks to you I can win at the races!—C.M., Seattle
At Golden Gate here from Feb. 16th opening day to March 24th the system showed a net profit of \$1728 on a \$20 flat win bet. A \$10 win \$10 place bet showed \$1257 net profit. From March 24th to present—the overall profit has decreased to \$1200 flat win (\$20).—B.S., El Cerrito, Calif.

ured the races and your method proved itself time and time again.—D.F., West Chester, Pa

I am the owner of many racing systems, all which are very good. When I received the system which I ordered from you I tried the system, I checked and rechecked it, and I can truthfully say that it is one of the best systems I own.—M.F.W., South English, Iowa.

Enclosed find results at the track for the last 2 months. It's incredible. I am ahead by \$1550. You may use by name for any testimonial.—L.O., Los Angeles, Cal.

Incidentally, I find that the system's choice comes in 2nd often enough that it pays to bet both win and place. In fact winnings as far as I've gone are just about double by betting

both. Thanks for being one of the honest solicitors.—B. F., Gila Bend, Ariz.
I owe you a million thanks. Just like you said, it doesn't work at all times, but I'll be honest with you the highest number always comes in the money.—E.S., Lorain, Ohio
I have been checking your method on some old forms for a period of 2 months so far and have found it profitable.—N. S., Mount Vernon, N.Y.

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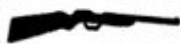
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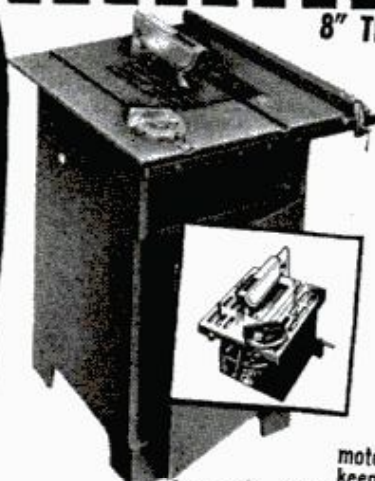
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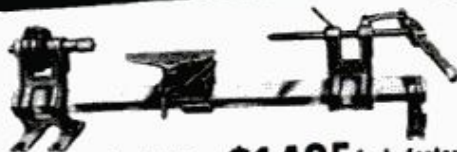
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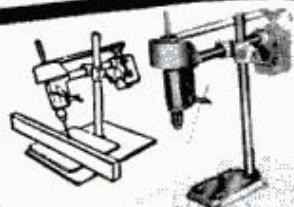
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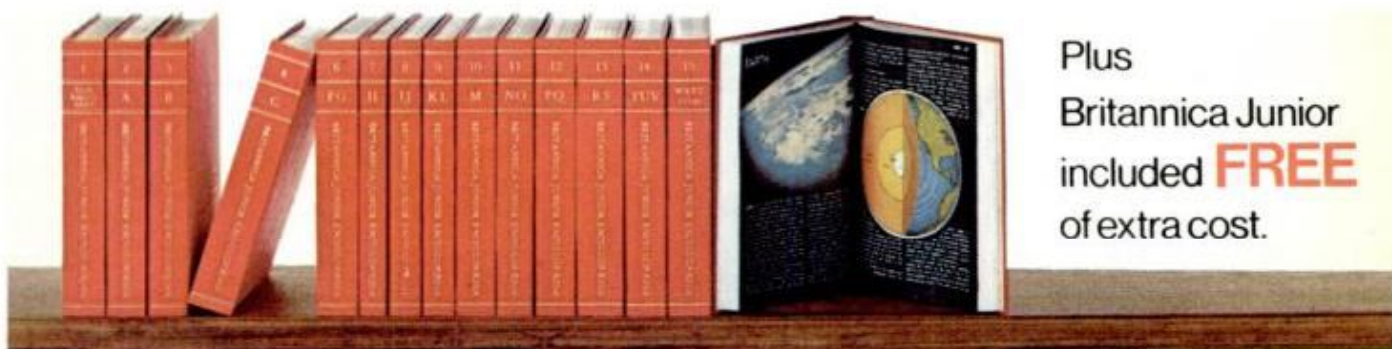
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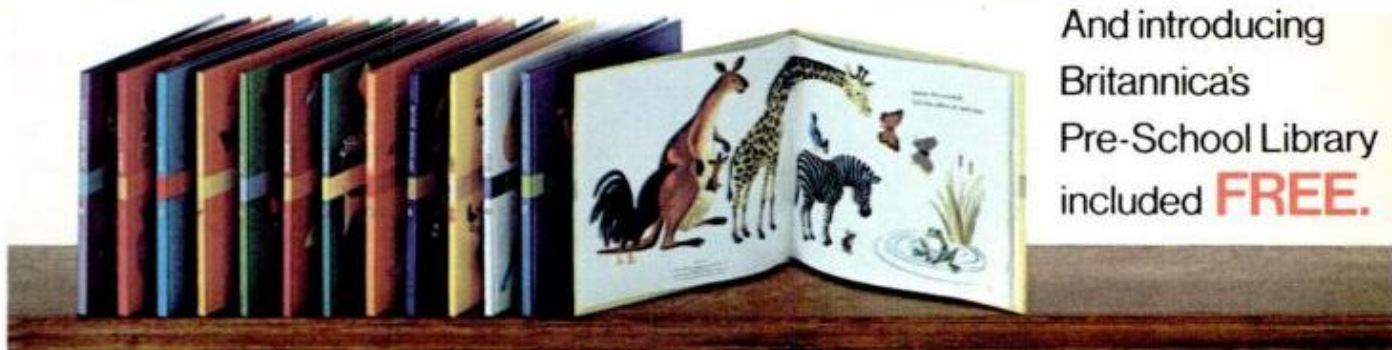
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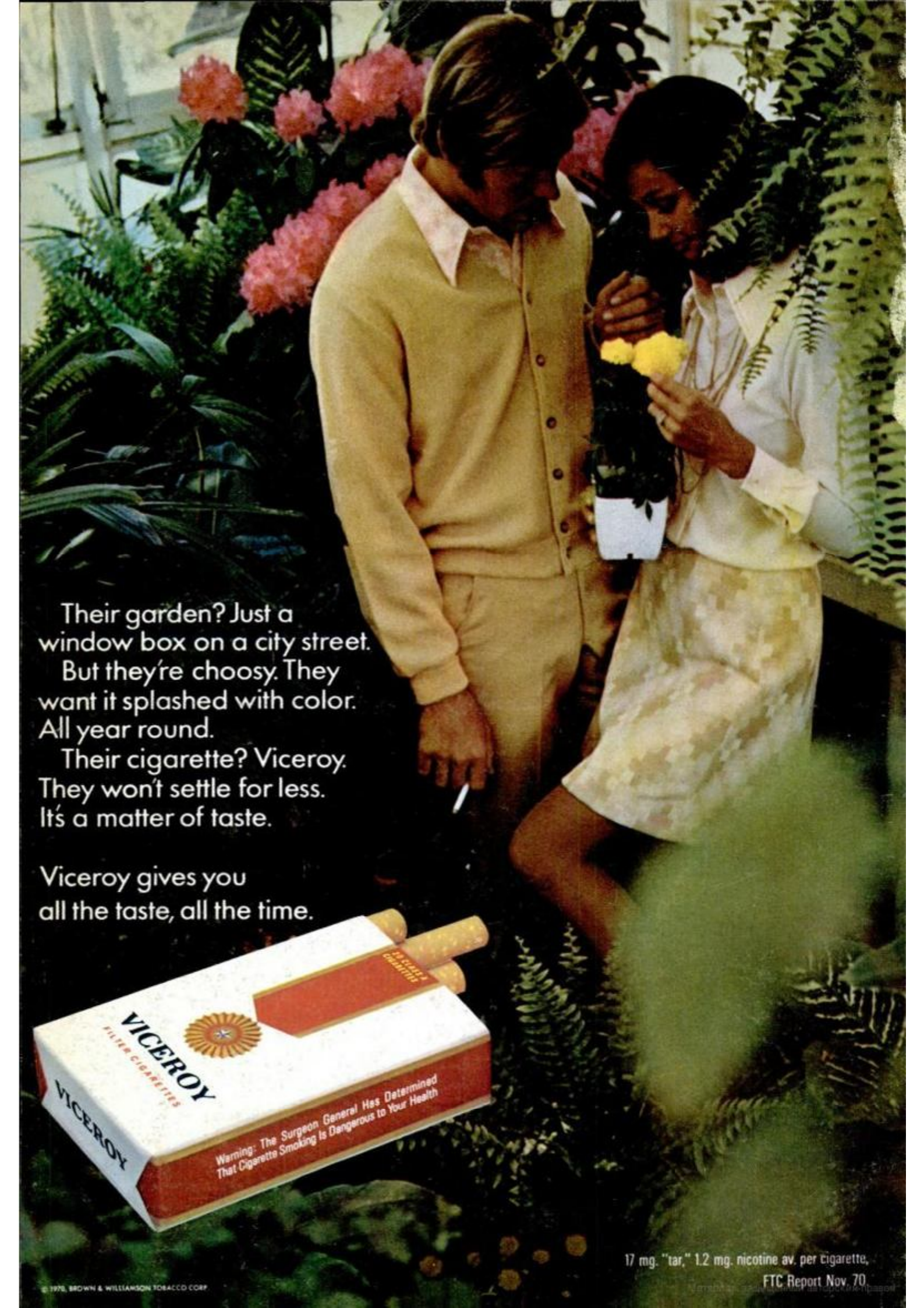
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